University of Alberta

The Anthropology of Native Copper Technology and Social Complexity in Alaska and the Yukon Territory: An Analysis Using Archaeology, Archaeometry, and Ethnohistory

by

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Abstract

Metal artifacts from archaeological sites have long been important to archaeologists interested in the origins (invention and diffusion) of metallurgy, and technology in general, as well as social complexity. In northwestern North America, native copper (*i.e.*, naturally occurring 99+% pure copper), was used by several different indigenous hunting-gathering-fishing groups prior to the influx of smelted metal via Euroamerican fur traders and explorers in the eighteenth century. This thesis presents an overview of native copper using archaeology, archaeometry, and ethnohistory within a general anthropology of technology framework. This approach examines the use of native copper for both utilitarian purposes and for objects of prestige. Native copper was a raw material valued for its potential use in functional, social, economic, and symbolic contexts and its possession was linked to the development and expression of social complexity in the region. A pilot study was undertaken to assess the potential to geochemically characterize native copper sources using Instrumental Neutron Activation Anaysis (INAA) and Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) to obtain trace element data on both native copper artifacts and native copper from sources. Laser-Ablation Multi-Collector ICP-MS was also used in an effort to obtain lead isotope data on native copper. The initial results indicate that native copper sources in the region can be differentiated to some degree based on trace element signatures, however, the numerous unsampled sources of native copper in the region prevent making definitive statements about the source of the native copper artifacts sampled in this study.

Preface

When people think of Alaskan archaeology metal artifacts do not generally come to mind. Nevertheless, my interest in native copper, and archaeometallurgy (the study of metal from archaeological contexts) began in Alaska in 1995. For two consecutive field seasons I worked at GUL-077, a Late Prehistoric (AD 1100-1500) Ahtna Athapaskan site near the community of Gulkana, which has produced more artifacts of native copper than any other site in Alaska, the Yukon Territory, or elsewhere in northwestern North America. The site was initially excavated by William Workman (1976) in 1975 and 1976, when the majority of native copper artifacts were found. In 1997 and 1998 I worked at another site that fueled my interest in archaeometallurgy, SIT-002 (Castle Hill), an historic Russian site in Sitka that at one time was the headquarters of the Russian-American Company. This site produced thousands of metal artifacts including debris related to the manufacturing of metal tools found in association with the brick foundation of a foundry, all dating to the 1820s-1840s.

Despite Workman's (1976) thorough discussion of the native copper technology at GUL-077 and other important work that highlighted (Shinkwin 1979), or focused on (Franklin *et al.* 1981) native copper in the region, I came to realize that there was still much unrealized potential in the study of native copper technology. It was largely due to the work of the above-mentioned scholars that I was motivated to pursue this research interest. Working at the historic Russian site caused me to wonder how the availability of metal traded into northwestern North America during the fur trade might have affected the value of native copper. Though this topic is broached in my thesis it is not the main focus because I soon realized that before attempting to understand how the value of native copper might have changed during the contact period, it would first be necessary to gain a better understanding of the value of native copper to indigenous groups before contact with Euroamericans.

Rather than focusing specifically on the native copper from GUL-077, which Workman (1976) discussed in some detail, I decided to take a more general

approach in my analysis of native copper technology in the region. It was my belief that future detailed, site-specific studies of native copper technology would benefit from a regional overview of the geological and archaeological occurrence of native copper as well as a review of what was known about indigenous attitudes towards native copper. However, this thesis does provide more detail on GUL-077 and its native copper than for other relevant sites in the region. This was done for two reasons. First, as mentioned above, this site has provided the largest collection of archaeological native copper in the region, which adds to the significance of this site within the context of an investigation of native copper technology. Second, though there are two reports (Workman 1976 and Hanson 1999) that describe archaeological work performed at this site, neither was published in a format that has made them easily accessible to researchers outside of the region. This thesis addresses the value of native copper regionally by examining the role of native copper in indigenous society through an anthropology of technology approach.

Acknowledgements

Though I began my student career at the University of Alberta in 2002, I have been interested in my thesis topic since 1995. As a result, I have many people to thank for providing valuable support in one form or another over the last 11 years. Funding for fieldwork and collections research was provided by the Canadian Circumpolar Institute through Circumpolar/Boreal Alberta Research grants.

I owe a huge debt of gratitude to the State of Alaska Office of History and Archaeology (OHA). It was during my time as a student intern at the OHA that I worked at GUL-077 in 1995 and 1996. Since then the OHA has aided my research a great deal and I want to thank the many people working there past and present who have assisted me in a variety of ways including: Judith Bittner, Rolfe Buzzell, R. Joan Dale, Allen Depew, Margie Goatley, Diane Hanson, Charles Holmes, J. David McMahan, Doug Reger, and Richard VanderHoek.

Professor Emeritus William Workman was my undergraduate supervisor at the University of Alaska - Anchorage (UAA) and conducted the initial investigation of GUL-077 in the 1970s. Since I graduated from UAA in 1997, Professor Workman has been supportive and encouraging of my native copper research and in addition to arranging for the loan of artifacts for analysis, both he and his wife Karen have always been willing to converse with me on this topic. I would also like to acknowledge Professor Allen McCartney, my supervisor at the University of Arkansas - Fayetteville, who was keenly interested in prehistoric metallurgy of the arctic and his research on this topic has inspired my own research.

I worked as a seasonal archeologist in Wrangell-St. Elias National Park and Preserve (WRST-NP/P) from 2001-2003 and returned in 2004 to conduct research. My work in the park was crucial for my research and I wish to thank all of the WRST-NP/P staff for their assistance and friendship. Of the many people at the park who provided invaluable support the following deserve special recognition: Anne Worthington, Michele Jesperson, Geoff Bleakley, and Danny Rosenkranz.

I have spoken with the following list of individuals about various aspects of my research and many have provided information about specific finds of native copper artifacts: Greg Hare, Shelia Greer, Mike Kunz, Robin Mills, John Cook,

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Randy Elliot and Bill LeBarge provided samples of native copper for the provenance research. Jim Wilder assisted with fieldwork conducted in WRST-NP/P searching for native copper. Collections research at the University of Alaska - Fairbanks Museum was facilitated by Daniel Odess (Curator of Archeology) and James Whitney (Archaeology Collections Manager).

The provenance portion of my research could not have been accomplished without the expertise and generous, willing support of several individuals at the University of Alberta. Dr. John Duke (Director, SLOWPOKE Research Reactor Facility) and Russell Ambeault (Laboratory Assistant, SLOWPOKE) contributed many hours and a great deal of effort running samples and educating me about Instrumental Neutron Activation Analysis (INAA). Dr. Robert Creaser (Associate Chair of Research, Earth and Atmospheric Sciences) made EAS facilities available for my research. Dr. Antonio Simonetti (EAS Radiogenic Isotope Facility) carried out the initial Pb-istope analysis using LA-MC-ICP-MS and then encouraged the additional use of EAS facilities, specifically ICP-MS, to obtain trace element results for comparison with INAA. Guangcheng Chen's (EAS Radiogenic Isotope Facility) contribution during the ICP-MS work was invaluable. It is my hope that all of the above-mentioned individuals feel the result was worth their effort.

I have been a student for several years in a few different places and have been fortunate to work with individuals who were considerate and thoughtful. After having become acquainted with numerous other graduate students from numerous institutions over the years I realize this is not always the case. My experience at the University of Alberta has been an exceedingly positive one, largely due to the excellence of my supervisory committee and I feel fortunate to have had the opportunity to pursue my PhD at the University of Alberta. I cannot at this point imagine having had a better supervisory committee to help me with the research that I wanted to pursue. My main supervisor Dr. Raymond Le Blanc convinced me (without even knowing it) of how fortunate I was to be able to work with an archaeologist that specializes in Athapaskan Culture. Dr. Michael Wayman was my

initial contact at the University of Alberta and encouraged me to apply to the Anthropology PhD program. He has patiently guided my efforts in the areas of archaeometallurgy and metallography and provided invaluable input and technical supervision. The third member of my supervisory committee, Dr. Charles Schweger, was an excellent addition as his geoarchaeological expertise was also invaluable. In addition to their knowledge and expertise, my supervisory committee was exceedingly generous, friendly, and helpful during my time at the University of Alberta. I would also like to thank the other members of my committee, Andie Palmer, Alex Wolfe, Andrzej Weber (Chair), and Michael Blake, for providing valuable comments.

I wish to thank my parents, Vernon and Doris Cooper, who have been very supporting during my several years of post-secondary study. I feel very fortunate to have had parents who, as educators themselves, value education not just as a means to improve one's standard of living, but also as a path towards understanding. And last, but certainly not least, I wish to thank my wife, Michele Buzon. Thanks to the fact that she completed her PhD in Anthropology relatively recently, Michele was able to provide not only emotional support over the last few years, but also much computer technical expertise that kept me from pulling my hair out as well as accompanying me into the field on copper collecting trips. Her love and support makes every experience, including graduate school, a richer one.

Though I have discussed my research with numerous people and received information and advice from many, any errors found herein are my own.

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Chapter 1. Introduction

Prior to the arrival of explorers and fur traders in northwestern North America in the eighteenth century, native copper was used by many indigenous groups and was often associated with prestige. Many sources of native copper (*i.e.*, naturally occurring 99+% pure copper metal) have been reported for the greater northwestern North American region (Figure 1.1) with a significant concentration occurring within the traditional territory of the Ahtna Athapaskans (Figure 1.2). The Ahtna are well known for their association with native copper, in both its trade and manufacture. Neighboring Tlingit, with whom the Ahtna intermarried, credited the Ahtna with the discovery of native copper and how to work it (de Laguna 1972).

Among the Ahtna Athapaskans copper was an important source of wealth and it has been suggested that their emphasis on ranking was related to their control of copper (Grinev 1993; Kari 1985; de Laguna and McClellan 1981; Pratt 1998). Though Pratt acknowledges, "the role of copper in the development of the highly non-egalitarian structure of Lower Ahtna society deserves consideration", he accurately points out that the state of our understanding regarding both the value of copper and the emergence of ranking falls short of what is necessary to confidently make this connection (1998:94). It was Baron von Wrangell (in Grinev 1993:56), the Russian American Company manager in 1839, who first suggested a link between the Ahtna copper monopoly and their emphasis on rank stating:

> differentiation of the Ahtna by wealth and class was no doubt favored by the copper trade which they carried on with other tribes. The Ahtna not only sold raw native copper but knew how to work it, in contrast to other Athapaskans.

This thesis makes use of archaeology, archaeometry, and ethnohistory (historic, ethnographic, and oral tradition sources) within an anthropology of technology framework to investigate native copper technology in Alaska and the Yukon. This approach will be detailed in the following chapter but can be summarized as a holistic approach to technology that examines its environmental,

social, political, and economic context. This contextual approach will also be used to assess the relationship of native copper to the development and expression of social complexity, specifically the creation and maintenance of rank, among indigenous groups in Alaska and the Yukon Territory.

Metals and metallurgy have both been implicated in the expression and development of social complexity by a number of researchers, generally in reference to middle-range societies, *i.e.*, chiefdoms, and states (*e.g.*, Binford 1962; Budd and Taylor 1995; Childe 1942; Earle 1997; Helms 1976; Knapp 1986, 1990; Leader 1988; Nakou 1995; Pollard 1987; Renfrew 1972, 1986; Shennan 1986; Sherratt 1994). Additionally, archaeologists have considered metal from archaeological contexts as a suitable vehicle for examining ideas such as value, prestige and power (Pydyn 1998; Voutsaki 1997). Previous discussions dealing with the relationship between metallurgy and social complexity have focused on the effect of smelting technology on the development and expression of social complexity in middle-range societies and states. This thesis focuses on the use of native copper in societies at the band or chiefdom level. This use of native copper, even without melting or smelting, is by definition metallurgy. As a result, this thesis takes what could be considered a bottom up, rather than top down approach to the relationship between metallurgy and social complexity.

The term "northwestern North America" is used in this thesis to include Alaska, the Yukon Territory, the northwestern part of the Northwest Territories and western Nunavut, and the Northwest Coast (coastal and adjacent interior British Columbia, Washington, and Oregon) (Figure 1.1). This large area encompasses three contiguous regions that contain deposits of native copper and provide archaeological evidence for the prehistoric use of native copper: (1) the southern Northwest Coast extending as far north as Prince Rupert Harbour; (2) the Central Arctic and Subarctic (encompassing Great Bear Lake, Coppermine River, Coronation Gulf, and part of Victoria Island); and (3) Alaska and the Yukon Territory, especially south-central Alaska and southwestern Yukon, the primary focus of this thesis. There will be some discussion of the use of native copper in the

two contiguous regions mentioned above in order to place the use of native copper in Alaska and the Yukon Territory within a larger regional context.

Much of the copper used by the indigenous peoples of Alaska, the Yukon Territory, and the Northwest Coast is believed to have originated from the copper-rich region of the Wrangell and Saint Elias Mountain ranges, which includes the Chitina and White Rivers (Figures 1.1 and 1.2). This region contains many localized sources of native copper used by resident Athapaskan groups such as the Ahtna, who controlled many of these sources, as well as the Tutchone, and Upper Tanana (de Laguna *et al.* 1964; de Laguna 1972; de Laguna and McClellan 1981; Emmons 1991; Grinev 1993; Keithahn 1964; McClellan 1975; McKennan 1959; Rickard 1939; Shinkwin 1979; Townsend 1980) (Figure 1.2). Many of the Alaskan sources fall within the boundary of Wrangell-St. Elias National Park and Preserve (WRST-NP/P). Native copper from this region, obtained primarily as placer nuggets from streambeds (Wayman 1989a), was traded to groups on the northern Northwest Coast such as the Yakutat and Chilkat Tlingit (de Laguna *et al.* 1964, 1972; Emmons 1991; Legros 1984; McClellan 1975) and was reportedly traded as far as the Queen Charlotte Islands (Acheson 2003; Brooks 1900).

This thesis has four primary objectives: (1) to provide a regional overview of the geological and archaeological occurrence of native copper, (2) to provide a contextualized discussion of the technology of native copper metallurgy, (3) to discuss the relationship between native copper and social complexity among the indigenous peoples of northwestern North America, and (4) to address the potential for provenance studies in northwestern North America, providing a foundation for future research. Though focusing on a single aspect of material culture may invite a narrow view of the past, native copper is worthy of attention for several reasons. It was used by numerous hunting and gathering groups of varying social complexity in northwestern North America; it was an important trade item linking different ethno-linguistic groups both near and far; it had utilitarian, economic, social, and symbolic value; and furthermore, an analysis of the distribution of archaeological native copper in Alaska and the Yukon has yet to be undertaken.

The following chapter (Chapter 2) provides a discussion of the theoretical trends linking archaeometallurgy with the anthropology of technology and explains the approach used in this thesis to examine native copper technology. Chapter 3 explains the geological origin and occurrence of native copper, specifically in Alaska and the Yukon Territory. Chapter 4 provides information on the use of, and attitudes toward, native copper by indigenous peoples in Alaska and the Yukon Territory based on ethnohistoric sources. An overview of the regional trade and exchange of native copper is also presented.

Chapter 5 provides an inventory of the archaeological occurrence of native copper artifacts for Alaska and the Yukon Territory based on published and unpublished sources. This is followed by a discussion of the regional distribution of native copper artifacts, a detailed discussion of the site GUL-077, which has produced the greatest number of native copper artifacts in the region, and a comparison of the native copper artifacts from GUL-077 with the sites having the next three largest collections of native copper artifacts (TNX-004, VAL-065, and YAK-007). The final section of the chapter is a discussion of the chronology of metallurgy in northwestern North America.

Chapter 6 presents the results of metallographic examination of eight native copper artifacts from GUL-077. The results of trace element analysis performed on 24 native copper artifacts from GUL-077 and material from three different sources using Instrumental Neutron Activation Analysis (INAA) and Inductively Coupled Plasma - Mass Spectrometry (ICP-MS), as well as isotope analysis using Laser Ablation (LA) Multi-Collector (MC) ICP-MS, are also presented in Chapter 6.

Chapter 7 provides a discussion of the regional use of native copper within a general anthropology of technology framework. Chapter 8 examines the relationship between native copper and social complexity in the region. Chapter 9 presents an overview of the results of this study as well as some concluding statements and a discussion of future research.

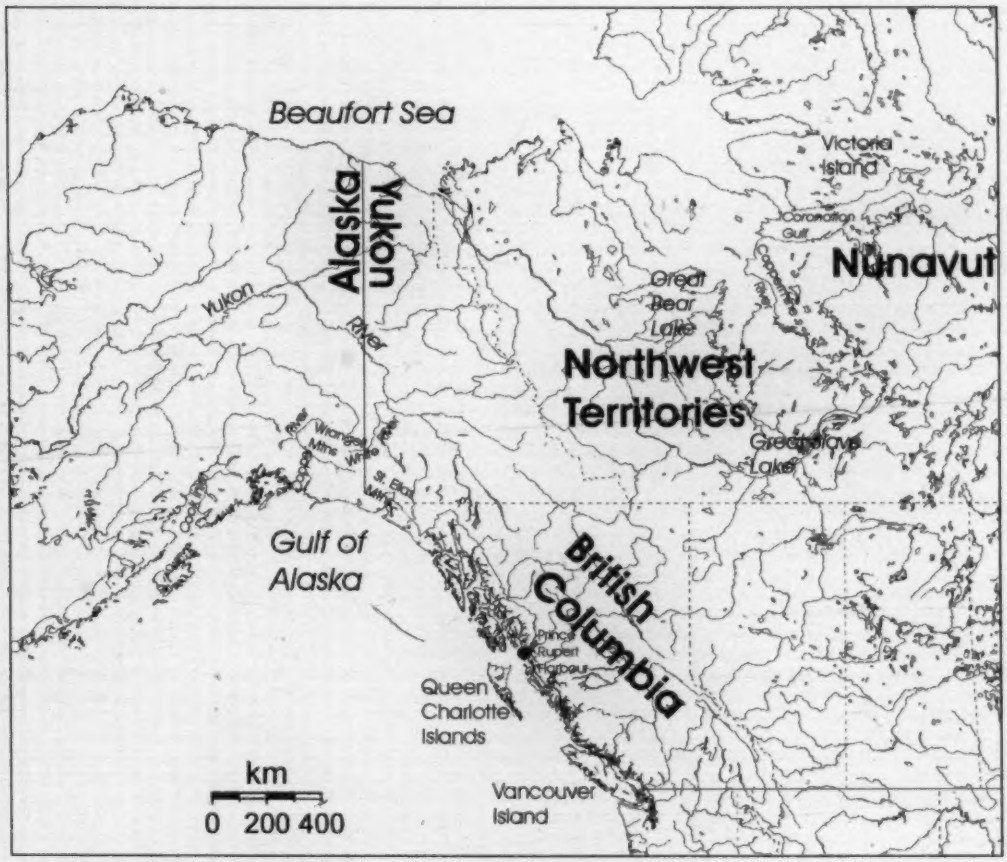

Figure 1.1 Northwestern North America.

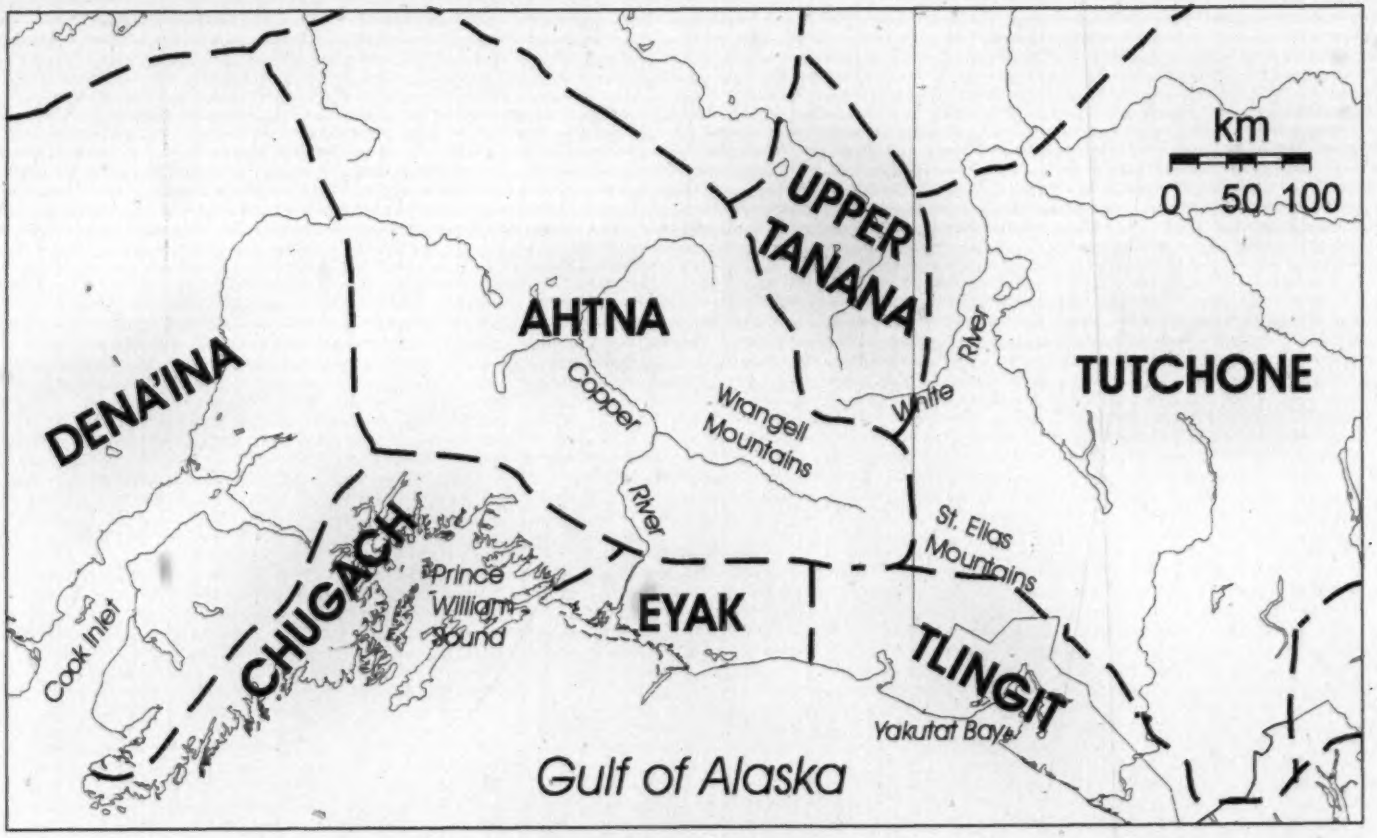

Figure 1.2 Map of ethno-linguistic groups for south-central Alaska and southwestern Yukon.

Chapter 2. Theoretical and Methodological Approach

Archaeometallurgy

Metal artifacts have long been an important source of information about the past. The Three Age System (Stone Age, Bronze Age, Iron Age), devised by the Danish scholar C.J. Thomsen (1836), arranged artifacts of stone and metal into time periods according to their stratigraphic context. This classification scheme allowed archaeologists to move beyond speculation and make generalized statements about the past based on a succession of technologies. The sequential appearance of stone, then copper and bronze, and finally iron tools in archaeological deposits in Europe encouraged a unilinear evolutionary approach to metallurgy and technology in general.

Archaeological materials can now be assigned to more specific time periods as a result of chronometric dating methods, but the use of the Three Age System, much revised and refined, persists. Though bronze did not entirely replace stone and iron did not entirely replace bronze, the general sequence of appearance of stone, bronze, and iron is repeated at sites throughout Europe and the Near East. As mentioned above, this observed sequence of stone to metal, and appearance of different metals, reinforced a unilinear, evolutionary view of metallurgy and technology in general. Such an approach rests on the assumption that the adoption of new technology was driven by the discovery and recognition of new materials that were either better than existing materials (*i.e.*, stronger, harder, sharper) and made functionally superior tools and weapons or were perhaps cheaper and more readily available.

Archaeological studies of metallurgy have traditionally focused on the technological requirements and constraints of the production of metals, the functional benefits of metal tools, and the availability of raw material, obtained either locally or through trade and exchange. These are all important aspects of archaeometallurgy. However, metallurgy includes more than the use, manipulation, and control of metals. Both quantitative and qualitative archaeometallurgical data

can provide a more detailed understanding of past human behavior and social interaction (*e.g.*, Childs and Killick 1993; Ehrenreich 1996; Franklin 1983; Lechtman 1977; Pigott 1996; Wayman 1991) and an increasing number of scholars have focused on the ritual and symbolic aspects of the production and use of metal artifacts (*e.g.*, Aldhouse-Green 2002; Alexander 1983; Bergstøl 2002; Budd and Taylor 1995; Ehrenreich 1991; Glumac 1991; Haaland, 2004; Hosler 1995; Lechtman 1984; Ottaway and Wager 2002; Prescott 2000; Renfrew 1978, 1986; Sørensen 1987; Trevelyan 2003; Young *et al.*, 1999) instead of, or in addition to economic, technical, and mechanical-functional aspects.

The Anthropology of Technology

As the previous section demonstrates, many scholars have become increasingly interested in a more holistic, contextualized approach to the study of technology, including metallurgy. Archaeologists have long been interested in technology, and have more direct access to technology, and its products, than to any other aspect of life in the past. The interest of archaeologists in the anthropology of technology over the last several years has been, at least, partly a result of material culture studies (including ethnoarchaeology) that have repeatedly demonstrated that a society's technology includes much that is not necessary from a purely technical or functional point of view (*e.g.*, Lechtman 1984; Hodder 1982 among others). An anthropology of technology approach draws on social science theory that acknowledges the impact of material culture on the creation and reproduction of social relations and cultural values (Appadurai 1986a; Bourdieu 1977; Hodder 1986) and focuses on technology as the result of culturally contextualized choices (Bjiker *et al.* 1987; Ingold 1988, 1990; Lemmonier 1992, 1993; Pfaffenberger 1988, 1992; Ridington 1982, 1988; Schiffer 2001).

As with most useful ideas within current anthropology, the roots of a holistic, contextual approach to the study of technology can be found in earlier work. V. Gordon Childe referred to technologies as "social products" (1954:39). Since then, many archaeologists have discussed the importance of the social context of technology (*e.g.*, Dobres and Hoffman 1994; Schiffer and Skibo 1997; Sillar and

Tite 2000) and specifically metallurgy (*e.g.*, Alexander 1983; Cobb and Ruggerio 2003; Derevenski and Sørenson, 2002; Dungworth 1997; Franklin 1983; Gale *et al.* 2003; Heskel 1983; Magnusson Staaf 2002; Pigott 1996; Renfrew 1978; Rosen 1984).

One important contribution to the development of an anthropology of technology comes from the French scholarly tradition of *technologie culturelle*. First formulated by Leroi-Gourhan (1964, 1965 in Lemonnier 1992), it focused on the *chaînes opératoires*, or "chosen techniques…applied to raw materials in sequences, and in particular combinations of raw materials, techniques, and sequences" (1992:25). Following within this tradition Lemonnier (1986; 1992; 1993), has made significant contributions to the formulation of an anthropology of technology. In his 1992 book, *Elements for an Anthropology of Technology*, he stated that "the anthropology of technological systems, or the study of material culture in a social and economic context, is still a new discipline" (1992:1).

According to Lemonnier (1992:1) "technology embraces all aspects of the process of action upon matter" and is not limited to "things and means used by societies to act upon their physical environment." Ridington (1982) has made similar comments de-emphazing the material aspect of technology. Referring to the technology of northern Athapaskans, mobile hunter-gatherers occupying the subarctic region of northwestern North America, Ridington (1982:471) stated "technology should be seen as a system of knowledge rather than an inventory of objects."

Lemmonier (1992) cites Mauss' definition of technique, which includes both *effective* and *traditional* action. Traditional action includes "magical, religious, or symbolic action" (1992:5) that is believed to effect a physical material change. In order to identify and investigate those aspects of technology that are considered arbitrary, *i.e.* non-functional, Lemmonier (1992:5) defines technique as technological action having "some physical intervention which leads to a real transformation of matter."

He goes on to define the "five related components" of technique (1992:5). The first component is *matter*, what the material techniques act upon (*e.g.*, clay,

lithics and metal but also water, plants, and the human body). The second component is *energy*, "the forces which move objects and transform matter." The third component is *objects*, otherwise known as artifacts, that are used to "act upon matter" (*e.g.*, hammer, awl, but also a factory). The fourth component is *gestures*, which move objects during technological action, and can be organized into sequences, or "technological processes." The fifth component is *specific knowledge*. Lemonnier states that this may or may not be expressed by the individuals involved in technological action and may be unconscious. Specific knowledge is composed of "know-how", or manual skills (1992:6) and is "the end result of all the perceived possibilities and the choices, made on an individual or a societal level, which have shaped that technological action."

Lemonnier uses the term *social representation* in referring to possibilities and choices and gives as examples of social representation: (1) the choice to use some materials but not others that are available; (2) "the choice to use …certain previously constructed means of action on matter (a bow and arrow, a car, a screwdriver)"; (3) "the choice of technological process (*i.e.*, sets of actions and their effects on matter), and the results of these processes (*e.g.*, a cooked meal, a house, or recently killed game)"; and (4) "the choice of how the action itself is to be performed" (*e.g.*, tasks relegated to or reserved for a certain gender or social class). Lemonnier (1992:8) discusses technological systems on three levels. First, the five related components of technique listed above "interact with each other to form a technology." Second, most technologies within a society are interrelated. Third, and closely related to the second level of addressing technological systems, is how they are integrated into society (1992:9).

Technological Choice

The work of Lemonnier (1992; 1993) highlighted the concept of choice within an anthropology of technology framework. When Lemonnier brought up the concept of technological choice in 1992, he indicated that the social context of technological choice, "why and how a given society uses a particular technology and not another" (1992:2) was under studied. He later defined technological choice

as the "process of selection of technological features invented locally or borrowed from outside" (1993:2).

One approach that can be subsumed under the broad heading of the anthropology of technology is the concept of 'technological choice', as outlined by Sillar and Tite (2000). Though they were primarily concerned with ceramic technology, their generalized approach is applicable to other technologies and will be used in this thesis to address the use of native copper. Their approach to technology and technological choice is influenced by the work of Schiffer and Skibo (1997) and Lechtmann (1977).

Schiffer and Skibo (1997:27) provided a theoretical framework that attempts to explain variability and change in technology by focusing on "that portion of formal variability in artifacts attributable to the behavior of the artisan." Their approach takes into account the context (environmental, social, economic, political, ideological) of technology and technological choices when examining the behavioral chain, or life cycle, of an artifact. Lechtman (1977:6) discussed technological behavior as encompassing many non-technical factors such as attitudes regarding materials and ritual observances. The technical and non-technical aspects of the production of objects, which according to Lechtman "are unified nonrandomly in a complex of formal relationships" (1977: 6), and constitute a "technological style."

Sillar and Tite (2000:4) define five areas of analysis within a technology where choices exist: (1) "raw material", (2) "tools used to shape the raw material", (3) "energy sources used to transform the raw materials and power the tools", (4) "techniques used to orchestrate the raw materials, tools, and energy to achieve a particular goal", and (5) "the sequence (or *chaîne operatoire*) in which these acts are linked together to transform raw materials into consumable products." Sillar and Tite (2000:4) state:

> These areas of choice are each influenced by their associated properties and performance characteristics and by a large range of social, economic, and ideological factors that shape the cultural perception of what options are available.

According to Sillar and Tite (2004:5) the "situational context impinges *directly*" [emphasis theirs] on the five areas of choice outlined above but the situational context also "impinges *indirectly* via the context of production, the distribution, and the use." In their discussion of social agency and technology Dobres and Hoffman (1994:213 [emphasis original]) also emphasize the need to consider the overall context of technology stating, "the concomitant social, political, and economic contexts of past productive activities are an especially important dimension of technology."

Though an anthropology of technology approach is intended to investigate more than just the objects produced by society, it does not ignore material realities. Materials analysis is an integral part of the examination of the context of technology (Dobres and Hoffman 1994; Jones 2005; Killick 1996; Kingery 1996a, 1996b; Sillar and Tite 2000). Sillar and Tite (2000:4) make explicit the need to integrate materials science with the anthropology of technology in the investigation of ancient technology:

> It is only through a consideration of the overall context that affects the availability of resources as well as the valuation of alternative techniques that we will be able to explain why particular technological choices were made and what material and social effects they had. This overall context spans the environmental and technological constraints, the economic and subsistence base, the social and political organization, and the ideology or belief systems of the people making the choices.

As Dobres and Hoffman point out "…only through detailed empirical identification of technical attributes, sequences, and *chaîne operatoire* that a more comprehensive and anthropological understanding of prehistoric technology can emerge" (1994: 214). More recently, Jones (2005), has proposed that a materials science approach can bridge processual and post-processual archaeologies.

Practical Versus Prestige Technology

Metals have been implicated in both the expression and development of social complexity by a number of researchers, generally in reference to middle-range societies and states (*e.g.*, Binford 1962; Budd and Taylor 1995; Childe 1942; Earle 1997; Helms 1976; Knapp 1986, 1990; Nakou 1995; Pollard 1987; Renfrew 1972, 1986; Shennan 1986; Sherratt 1994). Additionally, archaeologists have considered metal from archaeological contexts as a suitable vehicle for examining notions such as value, prestige, and power (Pydyn 1998; Voutsaki 1997).

The relationship between native copper and social complexity will be addressed in Chapter 8, but a preliminary discussion of one approach to this issue will be presented here. Inspired by design theory, Hayden (1998) outlined two separate types of technology: practical and prestige. According to Hayden (1998:2), "practical technology is meant to solve practical problems of survival and basic comfort" whereas "the purpose of creating prestige artifacts [*i.e.*, prestige technology] is not to perform a practical task but to display wealth, success, and power" (1998:11).

Hayden (1998:11) goes on to specify that prestige technology is intended to "solve a social problem or accomplish a social task such as attracting productive mates, labor, and alliances or bonding members of social groups together via displays of success." Hayden (1998) acknowledged "some prehistoric objects clearly incorporate aspects of both to varying degrees", but his proposed dichotomy of technologies, and the concept of prestige technology in particular, will be used herein to discuss the relationship between native copper and social complexity.

Style and Function

A thorough review of style and function is beyond the scope of this thesis but there are a few points relevant to the anthropology of technology. First and foremost is the idea that style has function. This was explicitly stated by Wobst (1977), and has been acknowledged by several other scholars (*e.g.*, Dietler and Herbich 1998; Hodder 1990; Lemonnier 1992; Roe 1995; Sackett 1977; Stark 1998) resulting in a break down of the style/function dichotomy. The maintenance of the

style/function dichotomy, which forces the separation of artifact attributes into those that are stylistic or those that are functional, but not both, prevents a truly holistic approach when examining variation in material culture (Stark 1998). As noted by Kingery (1996b:200), the "[s]eparation of aesthetics from technique, of tools from signs, of technofunction from sociofunction is an artificial construct of scholars searching for a reductionist mode of analysis."

Similar to the style/function dichotomy, the separation of technology from style has also proven to be artificial (Dietler and Herbich 1998; Hegmon 1998; Lechtman 1977). The same year (1977) that Wobst published his communication theory of style, Lechtman published another groundbreaking article dealing with the use of style in archaeology. She discussed technological behavior as encompassing many non-technical factors such as attitudes regarding materials and ritual observances. The sum of the technical and non-technical factors, which according to Lechtman "are unified nonrandomly in a complex of formal relationships" (1977: 6), constitutes a "technological style."

Following Lechtman (1977), Sillar and Tite (2000:8) note that style "resides in every stage of a technological process." The behavioral approach of Schiffer and Skibo (1997:27) with its focus on the behavior surrounding the production of artifacts, was offered as a way to move research beyond "unhelpful concepts, including style and function." A contextualized holistic approach to technology, *i.e.* the anthropology of technology, makes use of ideas surrounding the terms style and function, but moves beyond this essentially artificial dichotomy.

Materials and Methods

Archaeology

Chapter 5 includes an inventory of archaeological sites in Alaska and the Yukon Territory where native copper artifacts have been reported. This information allows for a regional analysis of the use of native copper. Both inter- and intra-site comparisons of native copper artifacts will be used to aid in establishing the context for this technology including its value and relationship to social complexity. Additionally, information on sources of native copper potentially available to

indigenous groups will be presented in order to provide a context for native copper technology and the trade of raw material.

Archaeometry

Metallographic analysis of native copper artifacts has been used to aid in the reconstruction of native copper technology and to interpret how cultures used and valued native copper (*e.g.*, Childs 1994; Franklin *et al.* 1981a; Franklin 1982; Vernon 1986, 1990). Metallographic analysis was performed on eight native copper artifacts from the archaeological site of GUL-077 in south-central Alaska. The results will be compared with previous analyses of native copper artifacts in order to help contextualize native copper technology in Alaska and the Yukon Territory.

Several researchers have alluded to the possibility of sourcing artifacts of native copper in south-central Alaska and the Northwest Coast (*e.g.*, Blake 2004; Franklin *et al.* 1981a; Shinkwin 1979). This thesis presents the results of source characterization work using Instrumental Neutron Activation Analysis (INAA), Inductively-Coupled Plasma - Mass Spectrometry (ICP-MS), and Laser-Ablation Multi-Collector Inductively-Coupled Plasma - Mass Spectrometry (LA-MC-ICP-MS). Native copper from three sources within WRST-NP/P and one archaeological site, GUL-077, were analyzed at the University of Alberta Slowpoke Nuclear Reactor Facility and the Department of Earth and Atmospheric Sciences Radiogenic Isotope Facility.

Ethnohistory

Ethnohistoric sources are used: (1) to describe how native copper was procured, worked, and used; (2) to provide some understanding of the value of copper; (3) to discuss social complexity, specifically the existence of ranking; and (4) to examine the relationship between ranking and copper.

Information from these sources is not used to reconstruct a static view of how things were in the past. Indeed, information from these various sources is sometimes contradictory. These contradictions indicate both regional and temporal variation in the use of native copper and indigenous attitudes towards it. This large,

diverse body of information includes accounts of early explorers and traders, statements made by indigenous people themselves, and the comments of anthropologists. These insights into the use of copper in the region are valuable in their own right for understanding indigenous worldviews, but also as a supplement to aid in the interpretation of native copper from archaeological sites. Furthermore, it is hoped that the insight gained from using non-archaeological sources to supplement the discussion of the relationship between copper and social complexity in northwestern North America will contribute to the larger issue of how metal, or any other prestige good, is related to the prestige of individuals and the emergence of ranking.

Summary

It is clear that many scholars have arrived at the same destination from different directions, that is, the social affects the technical. The value of a contextualized approach to the study of past technologies has been widely recognized, even though it may be difficult to practice. Archaeometry, or the materials science of archaeological materials, is an important aspect of a contextual approach. Determining how metal artifacts were made and what they are composed of is crucial for a contextual analysis of metallurgy. One could argue that anthropologically-informed archaeology, with its material focus, is in fact the anthropology of technology of the past. Though the study of archaeological metals requires material and structural analysis, there are many other factors besides those considered to be "technical" in the Western scientific sense deserving of study.

Chapter 3. The Geology of Native Copper

Origin and Occurrence

Metals make up a large portion of the earth's crust but react with other elements in such a way that they occur most often as minerals, rather than as pure elements. Rarely, however, metals are found in their elemental metallic form, known as "native" metals. Based on archaeological evidence, native copper is thought to be the first metal used by people in both the Old and New Worlds (Craddock 1995; Wayman 1989a). Other metallic elements that occur in a native state include gold, silver, and platinum. Of these, copper is by far the most abundant and has been estimated to be 100 times more widespread than both gold and silver. Iron, lead, and mercury may also be found in a native state but these instances are rare (Patterson 1971; Wayman 1989a).

Native copper is the term used for copper found in a metallic, elemental state as opposed to being chemically combined, as for example oxides, sulphides, or carbonates (Wayman 1989a). It can be found in many diverse geologic environments but primarily occurs in three: (1) extrusive and intrusive mafic igneous rocks, (2) the oxidized zones of copper sulphide deposits, and (3) in clastic sediments associated with igneous rocks and glacial till (Cornwall 1956; Rapp 2002). Deposits of native copper related to mafic igneous rocks are referred to as a *primary*. *Secondary* refers to deposits of native copper derived from the oxidation of sulphides and deposits associated with clastic sediments are referred to as *sedimentary* (Rapp *et al.* 2000). Primary native copper is the product of a copper-bearing hydrothermal solution. Examples are the basaltic lavas of the southeastern Alaska, southwestern Yukon, the Canadian Arctic and Lake Superior. Secondary deposits of native copper are the result of the weathering of exposed deposits of copper-iron sulphides (Cornwall 1956; Wayman 1989a).

Most native copper utilized in the New World prior to the arrival of Europeans originated from mafic igneous rocks. This material was available at or near the earth's surface. In the Old World, most native copper came from secondary deposits where it had been formed in the oxidized zones of copper-sulfide deposits

(Rapp and Hill 1998). The geologic processes that create native copper and copper ores determine the amount and type of impurities present (Maddin *et al.* 1980).

Native copper is noted for its purity, which is often greater than 99.9% copper. Arsenic and silver are the two most common elemental impurities with nickel, lead, antimony, iron and other metals also present in small quantities. These can occur as metallic inclusions (silver) or in solution in the copper. Silicon, calcium, aluminum, and magnesium can be present in the form of non-metallic inclusions, most frequently silicates or oxides (Patterson 1971; Tylecote 1992; Wayman 1989a).

Silver and arsenic are the most significant impurities associated with native copper and both can be present in solution with copper up to their respective solubility limits. Silver can occur as crystalline native silver in native copper deposits and may be present in concentrations as high as 40,000 ppm (4%). Arsenic is a chalcophile element with arsenic atoms actually replacing up to 8% of copper atoms in native copper. Because arsenic is found in significantly lower concentrations in secondary native copper deposits as compared to primary native copper from mafic and volcanic rocks, it can be used to differentiate copper from these two separate types of sources. Due to the abundance of iron in the earth's crust it is almost always associated with the formation of mineral deposits and will also be present in native copper (Craddock 1995; Rapp *et al.* 2000).

Though native copper characteristically has very few non-metallic inclusions, those found are often silicates. Oxides and sulphides are more commonly associated with smelted material. The melting of native copper could result in the introduction of contaminants from the vessel wall or reaction with the atmosphere (Wayman and Duke 1999).

Native copper has a Face-Centered Cubic (FCC) crystal structure. The FCC structure has four atoms per unit cell. One half of an atom at each of the six faces of the cube and one eighth of an atom at each of the eight corners for a total of four (Scott 1991). It is difficult to characterize the grain size of native copper because it can vary widely, but they are often of the order of 1 mm or greater; *i.e.* much larger than the grain size observed in smelted copper. Twinning is the growth of new

crystals during annealing that creates a mirrored plane within the crystal. Microscopically this can be seen in etched specimens as parallel straight lines that cross all or part of the metal grains. These twins can frequently be observed in native copper, often due to recrystallization caused by strain associated with geologic events. Native copper is heterogeneous with regard to grain size. Both large and small grains can occur and may be associated with gangue, *i.e.*, non-metallic minerals (Craddock 1995; Tylecote 1992).

Native Copper in Alaska and the Yukon Territory

Native copper has been noted as having a generally widespread occurrence throughout south-central Alaska (*e.g.*, Bateman and McLaughlin 1920; Capps 1916; Mendenhall and Schrader 1903; Moffit and Maddren 1909; Rohn 1900; Schrader and Spencer 1901; Wayland 1943) and southwestern Yukon Territory (Kindle 1953; McConnell 1905) (See Figure 3.1 and Tables 3.1, 3.2, and 3.3). This chapter provides maps of native copper sources potentially available to indigenous groups. The location of native copper sources are denoted on maps by the capital letter "C" followed by a number.

The native copper of the Copper and White River regions in Alaska and the Yukon occurs in primary deposits of basaltic lavas and interbedded sedimentary rocks (Cornwall 1956). White River native copper at Silver City, on Kletsan Creek occurs with chalcocite in "stringers and disseminations in altered Triassic basalt" (Carriere *et al.* 1981:6). Though these deposits are small, they are associated with a geologic environment similar to the Kennecott deposits of the Wrangell Mountains that have an ore grade of 13 % copper. The Kennecott-type deposits, which include native copper, are found in the lowermost 100 m of the Upper Triassic Chitistone Limestone, immediately overlying Triassic Nikolai Greenstone. Other copper deposits in the region associated with the Nikolai Greenstone have native copper (Carriere *et al.* 1981; MacKevett *et al.* 1997). The source of copper in this region is a 120 km long contact belt of Nikolai greenstone and Chitistone-Nizina Limestone running southeast to the Chitistone River from the Kotsina River (Mendenhall and Schrader 1903; Moffit and Maddren 1909).

Several copper mining operations were in existence in this region in the early part of the twentieth century but the largest was the complex of mines at Kennecott. Construction of 192 kilometers of railroad was required to gain access to the copper workings of the Kennecott copper deposits where 4,626,000 tons of ore were mined between 1911 and 1938, that when smelted, produced 591,535 tons of copper (Hunt 1996).

Additional copper deposits within WRST-NP/P are found north of the Wrangell Mountains in the upper portions of the Nabesna, Chisana, and White Rivers basins (Schrader and Spencer 1901; Mendenhall and Schrader 1903). Brooks (1900:382) also learned of the presence "float copper" in the Mentasta Mountains and "near the northeastern limit of the Alaskan Range." Moffit (1943:168) noted that in the Nutzotin Mountains, "many native copper nuggets have been picked up on bare hilltops where the old volcanics have been exposed to weathering." Though native copper is much more abundant in south-central Alaska and southwestern Yukon Territory, native copper has been reported for northern interior Alaska (Figure 3.2 and Table 3.4). The following chapter lists specific locations where Native groups collected native copper and Chapter 5 includes maps showing both the location of archaeological sites with native copper and native copper sources potentially available.

Table 3.1 Potential sources of native copper in southwestern Yukon Territory and south-central Alaska.

ID #	Name	Reference
C1	Kletsan Creek	Hayes 1892; Brooks 1900; Moffit and Knopf 1910
C2	Generc River	Cairnes 1915
C3	Beloud Creek	Kindle 1953
C4	Mush Lake	Kindle 1953
C5	Grafter Mine	Kindle 1964
C6	Burwash Creek	McConnell 1905
C7	Bullion Creek	McConnell 1905
C8	Sheep Creek, YK	McConnell 1905
C9	Fourth of July Creek	p.c. LeBarge
C10	Kimberley Creek	McConnell 1905
C11	Windy Arm	McConnell 1906
C12	Nisling River	Dawson 1899
C13	Tetamagouche	Muller 1954
C14	Middle Fork, White River	Brooks 1911; Moffit and Knopf 1910
C15	Nutzotin Mountains	Moffit 1943
C16	Chistochina River	Moffit 1954
C17	Slana River	Moffit 1954
C18	Nabesna River	Rohn 1900
C19	Sheep Creek, AK	Capps 1916
C20	Chisana Glacier	Mendenhall and Schrader 1903; Moffit and Maddren 1908
C21	Strelna Creek	Schrader and Spencer 1901
C22	Kluvesna River/Fall Creek	Mendenhall and Schrader 1903
C23	Kotsina Drainage	Schrader and Spencer 1901; Mendenhall and Schrader 1903
C24	Tsedi Kulaende	Kari 2005
C25	Nugget Creek	Moffit and Maddren 1909; Mendenhall and Schrader 1903
C26	Bear Creek	Mendenhall and Schrader 1903
C27	Nikolai Mine	Moffit and Maddren 1909; BIA 1995
C28	Chititu Creek	Moffit and Maddren 1909; Mendenhall and Schrader 1903
C29	Dan Creek	Moffit and Maddren 1909
C30	Chititu Creek	Moffit and Maddren 1909
C31	Young Creek	Rosenkranz p.c. 2004
C32	Glacier Creek	Moffit and Maddren 1909
C33	Chitina River headwaters	Mendenhall and Schrader 1903
C34	Hanagita Valley/ Chitina River	Mendenhall and Schrader 1903
C35	Bonananza, Bryan, and Chathenda Creeks	Cobb 1973

Table 3.2 Potential sources of native copper in Prince William Sound.

ID #	Name	Reference
C36	Lowe River	Abercrombie 1900
C37	near Cordova	Grant and Higgins 1910; de Laguna 1956
C38	NE of Orca	Grant and Higgins 1910; Moffit 1908; de Laguna 1956
C39	Hinchinbrook Island	de Laguna 1956
C40	Landlocked Bay	Capps and Johnson 1915; Grant and Higgins 1910
C41	Latouche Island	Grant and Higgins 1910; de Laguna 1956

Table 3.3 Potential sources of native copper in the Cook Inlet region.

ID #	Name	Reference
C42	Sheep Mountain	Turnbow 2002
C43	Carpenter Creek	Landes 1927
C44	Wolverine Creek	Landes 1927
C45	Mount Susitna	Kari and Fall 2003
C46	Lynx Creek	Moffit 1904
C47	Iliamna Lake	Martin and Katz 1910
C48	Newhalen River	Martin and Katz 1910

Table 3.4 Potential sources of native copper in northern interior Alaska.

ID #	Name	Reference
C49	Shungnak River	Smith, P.S. 1913
C50	Kogoluktuk/Noatak River	Smith, P.S. 1913
C51	Upper Kobuk Valley	Hickey 1976
C52	Mule Creek	Maddren 1913
C53	Little Minook Creek	Mertie 1934
C54	Hoosier Creek	Mertie 1934

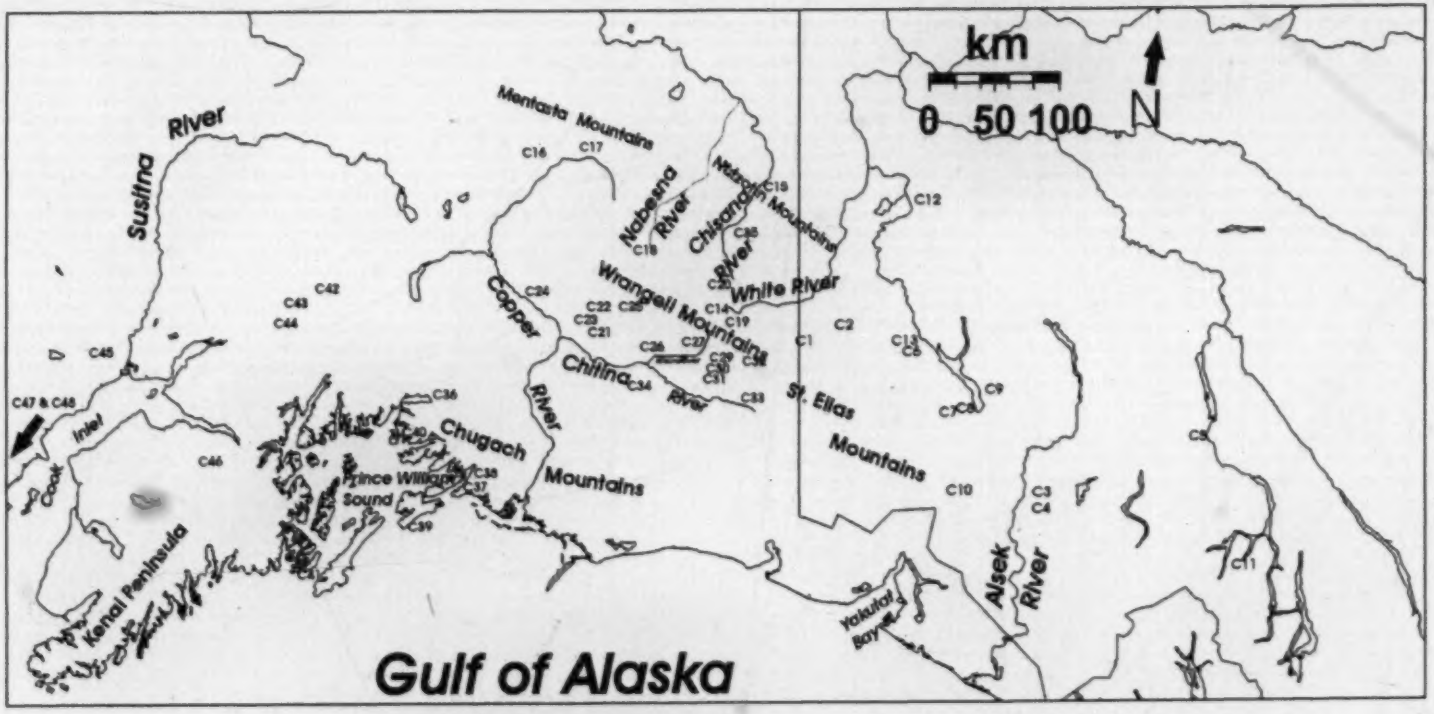

Figure 3.1 Potential sources of native copper in south-central Alaska and southwestern Yukon Territory.

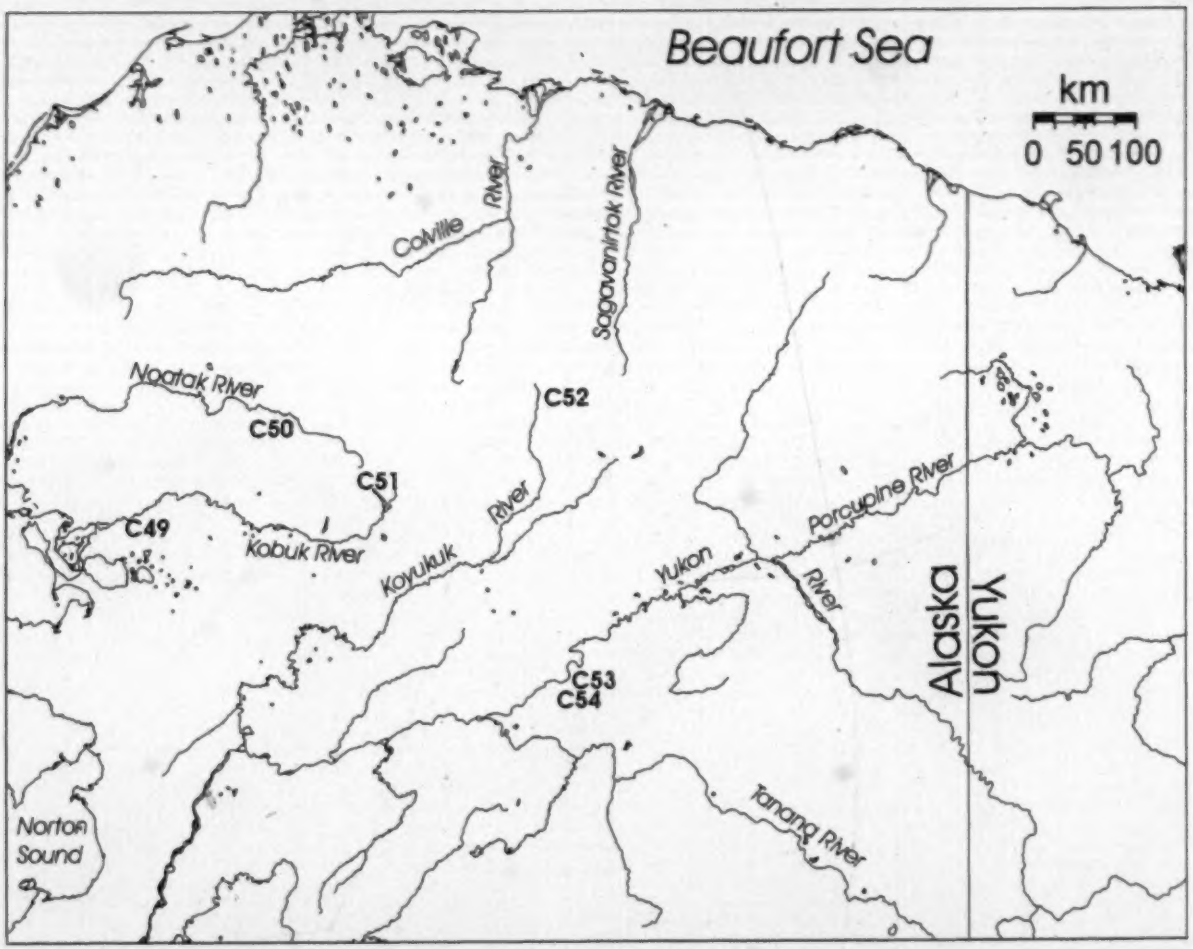

Figure 3.2 Potential sources of native copper in northern interior Alaska.

Chapter 4. Ethnohistory and the Indigenous Use of Native Copper

Several groups in Alaska and the Yukon Territory belonging to three different language families, Tlingit, Eskimo, and Eyak-Athapaskan, used native copper. These groups have been previously defined on the basis of language or dialect and territory (Figure 1.2). This chapter focuses on the use of native copper by Athapaskan and Tlingit groups as known from the ethnohistoric record. Much less information is available regarding the use of native copper by Eskimo speaking peoples in Alaska. Indigenous copper place names and locations associated with the ethnohistory of native copper are denoted on Figure 4.1.

The people grouped under ethno-linguistic terms such as Ahtna, Chugach, or Tlingit, did not think of themselves in terms of these labels. Though cognizant of cultural and linguistic differences between themselves and their neighbors, terms applied by outside observers that represent large tribal units have little social reality. As Townsend (1980) and VanStone (1974) have noted, indigenous groups thought in terms of smaller, more localized groups, often associated with distinct home territories and dialectical variants within the larger language groupings.

Northern Athapaskans, in particular, have provided a challenge to anthropologists with regards to defining social groups (Gillespie 1981; McKennan 1969; Osgood 1936; VanStone 1974). Northern Athapaskans generally self-identified in terms of local bands, but band membership was fluid, enabling a nuclear family to switch affiliation from one band to another (VanStone 1974). This was facilitated by the exchange of marriage partners, which created kin ties in neighboring groups, often across ethno-linguistic boundaries. This flexibility in band membership; and the existence of individuals fluent in more than one language and/or dialect, only served to complicate the efforts of anthropologists to define Athapaskan groups. Territorial boundaries were not always fixed and could change over time. Additionally, there was overlapping use of some areas by more than one group (de Laguna and McClellan 1981). When accomplished without conflict this overlapping use would have been peacefully facilitated by the existence of kin ties

in neighboring groups. Researchers have stressed that Northern Athapaskan groups represent a cultural continuum rather than discrete entities (Hosley 1981; McKennan 1969; VanStone 1974).

Despite the fact that the names for groups that have come into common use are constructs of western observers, the names applied to sub-groups do reflect real linguistic differences and territorial boundaries (Krauss and Golla 1981; VanStone 1974). As VanStone (1974:43) stated when referring to Athapaskans:

> While names such as Ingalik, Kutchin, Dogrib, or Slave had no social reality to the people involved, the subdivisions had not only territorial and possibly linguistic significance, but their membership included people who had frequent face-to-face contact with one another, who traveled and lived together, and who shared reciprocal obligations toward one another.

Indigenous Groups

Ahtna

The term Ahtna is used to denote the speakers of a distinct Athapaskan language in south-central Alaska. There are four Ahtna dialects: Lower, Central, Western, and Mentasta (or Upper). In the nineteenth century Ahtna territory included what is now known as the Copper River and its many tributaries as well as the headwaters of the Susitna and Matanuska Rivers and the adjacent uplands (Kari 1990; de Laguna and McClellan 1981) (Figure 1.2).

The Ahtna take their name from the term formerly applied to the Copper River, *Atna* (de Laguna and McClellan 1981). The meaning of the first part of this place name, *At*, is not known for certain but *na* is the Ahtna suffix meaning river (Kari 1990). When the Russians began attempts to explore Ahtna territory starting in the late 18th century they noted a dialectical difference between people living on the lower and upper parts of the Copper River. The Russians referred to the Lower Ahtna as *Mednovsty* ("coppers"), from their term for the Copper River, Miednaya Rieka (Grinev 1993; de Laguna and McClellan 1981).

Estimates of the Ahtna population for the 19th and early 20th century vary considerably but generally indicate that Ahtna territory was sparsely populated.

Allen (1887) estimated the Upper and Lower Ahtna together to comprise almost 400 individuals while Petroff (1884) indicates a decline of Lower Ahtna from 567 in 1818 to 250 by 1880. Abercrombie (1900) put the Lower Ahtna population at 350-400. Grinev (1993) suggests that at the end of the 18th century the vast Ahtna territory was occupied by no more than 1500 people. The Ahtna were organized into eight to ten matrilineal clans, which were divided roughly in half into either the Raven (Crow) or Sea Gull moiety (de Laguna and McClellan 1981).

Though the Ahtna ranged widely over their territory during subsistence pursuits, the more permanent winter settlements were concentrated along the Copper River or tributaries. In late spring and early summer different groups (bands) would congregate at strategic locations along the Copper River or tributaries in order to take advantage of salmon runs. By late summer and early fall people began to move into the uplands and depending on local availability hunted caribou, moose, goat, and sheep until the first snowfall. People then returned to winter settlements, usually located near fish camps, where dried salmon was stored in pits to be consumed during the winter. Certain species such as moose and hare could be hunted during the winter. By late winter early spring stored foods might be dwindling so that people were once again on the move hunting and fishing. Salmon was a crucial resource for the Lower Ahtna, who lived along the southern portion of the Copper River north of the Chugach Mountains. More northern and western groups depended more heavily on caribou (de Laguna and McClellan 1981; Reckord 1983).

The Ahtna are the group most often associated with native copper in Alaska. Commenting on their skill in metalworking in the 1800s,Von Wrangell (in Van Stone 1970:5) noted that from native copper they manufactured:

> ...metal hatchets, knives and breastplates for themselves and to sell to the Ugalentsy [Chugach], Kolosh [Tlingit?] and other peoples. Nowadays they have become the only blacksmiths who know how to forge iron which they obtain from the Russians.

The Ahtna were credited with the discovery of native copper and the knowledge of how to work it by the Tlingit (de Laguna *et al.* 1964; de Laguna 1972), who referred to the Ahtna as *?iqka* or *?iqkaha*, meaning "copper diggers" (de Laguna and McClellan 1981:662). The Ahtna term for native copper is *tsedi*, which translates literally as "that which is hammered," an obvious reference to how the material was treated. The Ahtna referred to a worker of native copper as *c'etseden*, meaning "one who hammers" (Kari 1990).

According to de Laguna and McClellan (1981:645) copper "demanded religious precautions to secure the nuggets, and specialized knowledge to shape it into knives, daggers, spear heads, and harpoon heads." According to Reckord (1983) copper working was a male activity. She also writes that the manufacture of copper objects (points and spears) "was a specialized trade among a few people living in villages near the Chitina River" (Reckord 1983:49). An Ahtna man mentioned copper being heated in fish oil before hammering (Shinkwin 1979). Powell (1997:187) was told by an Ahtna man that the Ahtna were able to "harden copper fairly well with an application of urinal ammonia, but the process was tedious" and the result was a tool inferior to steel.

As mentioned in Chapter 1, native copper was an important source of wealth and associated with high prestige and status. It has been suggested that the emphasis on ranking among the Ahtna was related to their control of native copper sources (Grinev 1993; de Laguna and McClellan 1981; Kari 1985; Shinkwin 1979; Pratt 1998). Ahtna chiefs may have claimed ownership of specific locations for collecting copper and it has been suggested that copper became a more restricted commodity from prehistoric to historic times due to the intensification of exchange associated with the Euroamerican fur trade (Shinkwin 1979). An Ahtna man told Shinkwin that all men had collected copper "but it all belonged to the chief" (Shinkwin 1979:27). Though individual chiefs were "famous" for possessing and collecting copper, it also provided group prestige (Shinkwin 1979). The Nizina area was claimed by the *wudjicyu* sib, or matrilineal kin-group, which may have resulted in the Lower Ahtna specifically having a monopoly on the copper trade with the coast (McClellan 1971). Reckord (1983:349) noted that Ahtna leaders organized the collection of

copper and credited the "stratified society that characterized Ahtna life in the nineteenth century" as helping to facilitate specialization in manufacturing copper objects.

Reckord (1983) noted two types of sites associated with Ahtna native copper technology, collecting and manufacturing. Families from the lower Copper River would travel to the region of the upper Chitina and Nizina River to collect copper in the spring in conjunction with sheep hunting. The copper would be taken back to communities near the confluence of the Chitina and Copper Rivers to be worked. However, native copper was worked at other locations. The site of *Tsedi Ts'ese' Cae'e*, "copper stone mouth" (Table 4.1 #1 and Figure 4.1), at the confluence of Dan Creek and the Nizina River was one of the camps of Chief Nicolai who is said to have worked copper there (Reckord 1983). Ahtna copper collecting and manufacturing activity have both been verified in the general area by the discovery of a wooden shovel and birch bucket "in loose waste below an outcrop of native copper…on Glacier Creek" and the recovery of " spear and arrow heads of copper" from sluice boxes by miners working on Chititu and Dan Creeks (Moffit and Maddren 1909:19).

Both archaeological and ethnohistoric sources indicate the Ahtna used native copper for a variety of objects. Metal was used for ear and nose ornaments (de Laguna and McClellan 1981) and it is possible that the "ear and nose rings of brass" worn by men that Abercrombie (1900:404) noted may have been native copper. Moffit and Maddren (1909:19) reported that Ahtna used "ceremonial knives of copper…for cutting the first salmon caught in the beginning of the season's run." There is no indication that this ceremonial knife differed in form from other knives. Kari (1990) presents several Ahtna terms for copper objects (see Table 4.2).

Though the "breastplates" mentioned by Von Wrangell above (in VanStone 1970:5), and perhaps other objects in the post-contact period, may have been fashioned from trade metal, the Ahtna continued to use native copper well into the post-contact period. On his 1885 expedition Allen (1900) noted that the Ahtna were using native copper for bullets, which were apparently hammered into shape. While

at Suslota Lake in 1900 Powell (1997:139) heard of a young man who killed a bear using a bow and "several…copper pointed arrows."

Native copper has been reported for several localities within traditional Ahtna territory, most of which fall within the Lower Ahtna region: Strelna Creek and "various localities within the Kotsina drainage" (Schrader and Spencer 1901:84), the Chisana Glacier (Tinast) (Mendenhall and Schrader 1903), Sheep Creek (Capps 1916), Middle Fork of the White River and Moraine Creek (Moffit and Knopf 1910), Nugget Creek, Glacier Creek, Dan Creek, and Chititu Creek (Moffit and Maddren 1909), Kluvesna River and Fall Creek (Moffit and Mertie 1923), Young Creek (Rosenkranz personal communication 2004), Bear Creek, Chisana River (Cross Creek), the headwaters of the Chitina River, the mountains between Hanagita Valley and the Chitina River (Mendenhall and Schrader1903) (see Figure 3.1 and Table 3.1).

There are nine place names known for Lower Ahtna territory that incorporate *tsedi* (Kari 1983), some of which still survive today on maps in some form. *Tsedi Kulaende*, "where copper exists," is associated with where the Ahtna are reported to have discovered native copper (Kari 2005). A nearby stream was called *Tsedi Kulaende Na* "where copper exists creek." As noted above, the current Copper River was once known as *Atna*, from where the term Ahtna derives. The real Copper River of the Ahtna people is the Chitina River. Chitina comes from *Tsedi Na*, meaning copper river. Additional place names include: *Tsedi Cae'e* = copper mouth (mouth of Chitina River), *Tsedi Tu'* = copper water (Chititu Creek), *Tsedi Ts'ese' Na'* = copper stone creek (Chitistone Creek), *Tsedi Ts'ese'* = copper stone (a mountain known today as The Finn), *Tsedi Ts'ese' Tates* = copper stone pass, *Tsedi Ggalaaye'* = copper mountain (either Mount Steele or Mount Luciana) (Kari 1983, 1990) (Figure 4.1 and Table 4.1, also Figure 3.1 and Table 3.1).

A well-known story among the Ahtna concerns *Cuuyi* (also *Kuyee*), a chief from around Gulkana who was remarkably small. According to oral tradition, the site of GUL-131 (Figure 4.1), known as *Cuuyi Ak'ae*, was the site of Cuuyi's Village (Gibson and Mischler 1984). This enterprising individual obtained copper from around the confluence of the Copper River and Chitina River (in the form of

points and spears), which he then took north to trade with the Tanana. The exact location of this transaction is unknown. He was able to acquire so many furs in exchange for his copper that he had to barter some of them back in exchange for slaves to help him carry his load back home (Reckord 1983). Kuyee's village was reported to have been at the mouth of Bear Creek where he was the leader of 60 people and lived in a large house made of lumber constructed with the aid of copper nails (Gibson and Mischler 1984).

De Laguna (1972) collected a story concerning the origin of copper while working in Yakutat Bay. Though it is a local Tlingit story, it indicates that copper was discovered by the Kwackwan, a group of Ahtna, before they traveled to Yakutat Bay and were integrated into Northern Tlingit society. According to this story, before the Kwackwan came to the Yakutat Bay (specifically *Ganawas*, or Knight Island) there was a woman slave who had a son. The two were poor and of low status. They left their village to live in the mountains and after four years the boy had grown into a man. Once while out hunting the young man was visited in his sleep by a spirit. The spirit led him on to a successful hunt and one night appeared as four blue flames in his campfire. The next morning the young man found four fist-sized coppers in the ashes where the four blue flames had been. He did not know what they were but he used some of the copper to make an arrowhead, which he then used to kill a moose. After revealing this gift to his mother she promptly decided to return to the village where they had been mistreated. When the chief saw the copper he became excited and wanted to know where they had gotten it. But the mother demanded that he recognize them first, which he did. Afterwards they looked for copper every spring but it was the young man's mother who showed them where to find it.

Dena'ina

The Dena'ina (also Tanaina) are an Athapaskan speaking group that occupy the region surrounding Cook Inlet (Figure 1.2) (Townsend 1981). The Dena'ina language has two major subdivisions, the Upper Inlet, which consists of a single

dialect and the Lower Inlet, which has two. Linguistically Dena'ina is closely linked to the Ahtna, especially the Upper Inlet and Western Ahtna dialects (Kari 1977).

The Dena'ina were organized into moieties further subdivided into matrilineal clans. Dena'ina subsistence was based on salmon with five different species available in Cook Inlet. Freshwater fish and land mammals such as caribou, moose, bear, and sheep were also important (Townsend 1981). Unlike other Athapaskan-speaking peoples the Dena'ina occupied a coastal environment and made use of marine and littoral resources such as seals and clams.

There are at least two sources of native copper reported within Dena'ina territory. Lynx Creek on the Kenai Peninsula (Moffit 1904), and Mount Susitna (Kari and Fall 2003) (Figure 3.1 and Table 3.3). The Dena'ina use the same term for copper, *tsedi*, as the Ahtna. There are two Dena'ina copper place names associated with the Mount Susitna source. *Tsedi Bak'ilanitnu*, "creek in which there is copper", flows out of *Tsedi Bak'ilani*, "the one in which there is copper", a canyon at South Peak. These place names are located just south of Mount Susitna (Kari and Fall 2003) (Figure 4.1 and Table 4.1).

Shem Pete, a Dena'ina man provided an account of the discovery of native copper from *Tsedi Bak'ilani* (Kari and Fall 2003:111):

> ...way before the Russians came they found a big [piece of] copper walking around. It looked like a big porcupine. He [the man who found the copper] peed on that copper walking around. They found the (that?) maybe four hundred or five hundred years ago, before the Russians came to Alaska. A rich man's cousin hunted around Dghelishla. He saw that copper kinda walk around, come alive, I don't know. It gave him luck. That's where that chief got lucky. That porcupine copper died. He got lucky. They cut a little piece and make arrow point. They got rich outa that copper. They sell that.

The Dena'ina recognized some individuals as being especially adept at working copper. Such an individual was referred to as *nuk'qetset*, "they pound it", and were themselves "very valuable." A skilled copper worker reportedly stayed in the woods, presumably at a distance from a settlement, in order to avoid being killed if there was an attack (Kari and Fall 2003:111).

Osgood (1937:102) provided a description of Dena'ina copper knives stating that they were:

> long thin, and have handles ending in double spirals. The handles are sometimes reinforced with spruce wood. At Kenai a few rich men own copper knives. These, however, have only small blades about an inch long which are hafted in handles four inches long. Copper knives are gained in trade from the Upper Inlet people who in turn buy them from the Copper River people to the eastward.

The Dena'ina of the upper portion of Cook Inlet and around Kenai also had adzes and necklaces of native copper that were either fashioned in, or acquired from, the Upper Inlet Dena'ina (Osgood 1937).

Osgood (1937:188-189) recorded a Dena'ina story apparently related to the origin of native copper. A man named Tcu-Kun killed his wife because she was unfaithful, after which he lived in the woods and was greatly feared because he continued killing people. During his time in the woods he found "something like gold" in a creek and made several tools with it including an ax, spear, and knife. One day a poor boy (low status) encountered Tcu-Kun who said, "Don't cry little boy, I won't hurt you. I want you to kill me, I'm tired and old." Tcu-kun piled up his metal and offered it to the boy as payment for killing him. The boy did as instructed and killed Tcu-kun. He then went to the house of the chief and said that he had killed Tcu-kun. No one believed him until they went to see. The chief took a metal knife and ax for himself and allowed the boy to have the rest. The chief then married the formerly poor low status boy to his daughter.

Tanana/Upper Tanana

The term Tanana has been applied to those Athapaskans occupying the Tanana River watershed from its headwaters to the Tolovana River. The Tanana region is home to three different Athapaskan languages, Upper Tanana, Tanacross, and Lower Tanana, each of which has at least two dialects (McKennan 1981). The following discussion focuses mostly on the Upper Tanana due to the greater amount of detailed information available on their use of native copper.

Late 19th and early 20th century population estimates for the region range from 700 (Petroff 1884) to less than 400 (Brooks 1900). As with other estimates of Native populations these estimates post-date numerous epidemics including smallpox in 1838-9, scarlet fever in the 1850s-60s, and influenza. There were three exogamous matrilineal descent groups among the Tanana, each of which was frequently associated with an animal. The seasonal round focused on the hunting of caribou using fences and corrals in the fall and fishing in spring and summer. In addition to caribou, moose and small mammals were also hunted. Whitefish were caught using traps and dip nets and salmon were procured from small clear-water streams downriver and from the Tanana River using weirs and dip nets, respectively. Subsistence demanded a great deal of mobility with bands dispersing into smaller groups at certain times of the year (McKennan 1959, 1981).

The Upper Tanana Athapaskans traditionally inhabited the region that encompassed the headwaters of the White River and the Tanana River, including the Nabesna and Chisana Rivers, (McKennan 1959) (Figure 1.2). Osgood (1936) referred to this group as the Nabesna. According to McKennan (1959), the population of the Upper Tanana region in 1929-30 was 152, distributed amongst five different bands. The population prior to the introduction of Euroamerican disease was certainly greater, as many Upper Tanana people professed (McKennan 1959). Those living in the Nabesna River drainage had close ties with the Ahtna, including the exchange of marriage partners. Though the Upper Tanana did not have access to the annual runs of salmon, they did make use of freshwater fish. Moose and sheep were hunted at various times of the year, but according to McKennan (1959:47), "the economic life of the Upper Tanana centers around the caribou." McKennan (1959) noted a variety of house types for the Upper Tanana that fall into two categories, semi-permanent and temporary. McKennan's (1959) description of the Upper Tanana seasonal round indicates a great deal of mobility in pursuit of food resources.

Native copper was available in several locations in Upper Tanana territory. The geologists Mendenhall and Schrader (1903:39-40) encountered Natives living on the lower part of Cross Creek who:

> had in their possession collections of native copper nuggets, ranging in size from a shot or pea to several inches in diameter. The collections contained perhaps 100 nuggets, averaging about one-half inch in diameter, this being the most common size. The largest piece seen weighs 35 to 40 pounds, and as is true of most of the larger nuggets, is irregular in form and partially coated with malachite.

This native copper was reportedly collected from a tributary of the Chisana River near the Chisana Glacier. McKennan (1959) noted that the Upper Tanana obtained nuggets of native copper from the upper portions of the Nabesna and Chisana Rivers and Kletsan Creek. Chisana is derived from *tsetsaan' na'*, meaning copper river. *Tsetsaan'* is the term for copper used by most Northern Athapaskan speakers and translates literally as "rock excrement" (Kari 1983) (Figure 4.1 and Table 4.1).

During archaeological survey in Alaska, Froelich Rainey collected a description of how copper tools were made from Old Sam (Sam Thomas):

> Find nugget of pure copper on hill back from Nabesna River, hammer it out on stone anvil with sharp stone pick; flatten out and shape; then hammer down to paper-thin; break off residue with fingers; smooth and sharpen edge with whet stone (Rainey 1939: Diary; Upper Tanana, June 2).

Sam had seen his father make tools when he was a boy and Rainey noted that due to Sam's age the tool manufacturing he witnessed probably took place during the period from 1865 to 1876.

While conducting ethnographic work among the Upper Tanana and their neighbors in 1929-1930, Robert McKennan (1959) collected information about their use of native copper. According to McKennan (1959:65), it was a common raw material for knives, adzes, drills, awls, and nose and ear ornaments and along with bone and horn, was used more often than stone, "except for mauls and occasionally adzes." He specifies that nuggets of native copper were worked by cold-hammering. Oswalt (1973:118) describes the use of copper by the Upper Tanana for leisters and spear points used to kill bears.

In more recent times Patrick Saylor (in Callaway and Miller-Friend 2001:106), a Tanana Athapaskan, commented on the use of native copper by his grandfather's generation:

> copper was very treasured and some of the blacksmiths, one of the last ones was, was my Grandpa, Grandpa Sam's brother, Nothol where, at the point where I'm down at, he had a tent frame and stuff down there where he would hammer up in the valley there between the old village and my house. He had a rock, a rock just like a smith would have for hammering iron. And he would get, trade for the copper. Trade 'em paint. We had famous paint, red paint that came from this area and other things we traded with the Copper (Copper River/Ahtna) to get their metal which we'd pound and folded until we had a triangular like dagger that…

According to McKennan (1959:58), native copper was the preferred material for knives of which there were two forms. One was "a single-edged blade about 6 inches, fitted with a handle of wood or horn" and the other is more dagger-like with "…a fluted doubled-edged blade about 1 1/2 inches wide and 9 inches long. The metal handle, padded with leather, terminates in flaring, voluted antennae." The first form is some times referred to using the Eskimo term *ulu*, also known as a "woman's knife" and associated with processing fish. An adz of native copper was the "most important weapon" and there was a "single-bladed pickax…made expressly for war purposes" (McKennan 1959:97). The Upper Tanana traded native copper to other Athapaskan groups further into the interior (McKennan 1959), but were blocked from trading with people on the coast as both the Ahtna and Tutchone, who had access to numerous deposits of native copper, lay between them and the coast.

Nabesna John told the story of the origin of copper to McKennan. Tsa-O-Sha was a man who lived long ago and passed along much technology to the people giving them things such as snowshoes, canoes, and caribou bone arrows. Long ago he also told a person, "I have left metal for you at the head of the Chisana River (Figure 4.1). On one side of the valley you will find copper; on the other side you will find iron. In the creek you will find another metal." The individual so instructed located the copper and the iron but did not make use of the iron finding it "too

brittle." This person did not look for the metal in the creek, leading Nabesna John to speculate that maybe this was the gold later sought by Euroamerican miners (McKennan 1959:176).

Another story involving Tsa-O-Sha provided by Chisana Joe gives an account of Tsa-O-Sha's triumph over Wolverine who was killing many people. In this story Wolverine is killing people with the aid of a trap in which he sets poles with copper points. Tsa-O-Sha pretends to be killed in Wolverine's trap in order to be taken back to Wolverine's house. Once home, Wolverine cannot find his copper knife to cut up Tsa-O-Sha so he begins to make a new one. As soon as he began to hammer the new knife Wolverine's wife "started to get the fire ready" (McKennan 1959: 176). While Wolverine and his wife were occupied, Tsa-O-Sha jumped up, grabbed a pick-ax, and killed them both. Tsa-O-Sha continued killing members of the Wolverine family until there was only an old woman left up in a tree. When Tsa-O-Sha attempted to shoot her down using a bow and arrows, she caught the arrows with the aide of her copper gloves and threw them back at him. When Tsa-O-Sha tried to chop down the tree with a copper pick-ax the old Wolverine woman said, "copper no hurt" and the pick "fell away and would not cut." Tsa-O-Sha eventually let her go after she promised not to kill any more people (McKennan 1959: 177).

Koyukon

The Koyukon Athapaskan occupy the northwestern interior of Alaska including the lower and middle portions of the Yukon River and the Koyukuk River south of the Brooks Range. The Koyukon language has three major dialects and several sub-dialects (Clark 1981). Like other Athapaskan groups Koyukon social organization focused on the band, which operated as unit with regards to both residence and subsistence pursuits. The seasonal round focused on intercepting species that were available for limited times during the year such as salmon, waterfowl, and caribou. The Koyukuk people were organized into three exogamous matrilineal clans, including one associated variously with iron, copper, and bear (Clark 1975, 1981).

De Laguna (1995:199) recorded the story of "How the Three Clans Got Their Names" at Koyukuk Station (Figure 4.1). Three warring tribes came together to make peace and "decide what to call one another." The first man who was asked as to what he should be called was a Black Bear. He replied, "I did not come from on top of the ground. I came from underground, and in coming through the ground I passed copper and all kinds of different minerals. So I want to be called Copper. *Noltseene* (Copper People)." When asked to prove that he had come from underground he showed a piece of copper he had in a sack.

Tutchone

The Tutchone Athapaskans occupy the southern part of the Yukon Territory (Figure 1.2). Linguistically they can be divided into two groups, referred to as Northern and Southern Tutchone. Like other interior Athapaskan groups, the Tutchone led a mobile hunting and gathering lifestyle. Salmon, freshwater fish, waterfowl, caribou, mountain sheep, and smaller mammals were all used for subsistence but there were localized differences in availability. Though there were no settlements occupied year-round, prime fishing locations associated with lakes or rivers were revisited annually and often became centers of trade. The Tutchone were organized into matrilineal clans that belonged to one of two moieties, Crow (or Raven) and Wolf. Some Southern Tutchone took on Tlingit social institutions such as clan system, named lineage houses, and ranked lineage statuses due to their intermarriage with the Chilkat Tlingit from coastal Alaska (McClellan 1981).

According to McClellan (1975) the Southern Tutchone had better access to native copper than the Northern Tutchone. Native copper was dug from river gravels at Kletsan Creek (Brooks 1900; Schwatka 1996), a tributary of the White River, and the Generc River (Sabina 1973) (Figure 3.1 and Table 3.1 #s 13 and 14) using caribou or moose antler. Kletsan comes from the Athapaskan term for copper, *tsetsaan'*, and this creek was formerly known as Klet-san-dek, meaning copper creek (Orth 1967). While traveling through Tutchone territory Glave (1892) recorded the Native name *Eark Heene* (written "*Erk-heen-ee*" on Glave's map pg.

869) for the White River (Figure 4.1 and Table 4.1). The same name was used by the Tlingit to refer to the Copper River in Ahtna territory (Emmons 1991).

Though the Southern Tutchone may have had more direct access to native copper, the sources they exploited were probably exploited by other neighboring groups (McClellan 1981), and Schwatka (1996) was shown the Kletsan Creek source by Tutchone he met in Northern Tutchone territory. Other locations in southwestern Yukon reported to have native copper include: Beloud Creek and Mush Lake (Kindle 1953), Grafter Mine near Whitehorse (Kindle 1964), and several creeks near Kluane Lake (McConnell 1905). Native copper has also been reported near Windy Arm in Tagish territory (McConnell 1906) (Figure 3.1 and Table 3.1).

According to information collected by McClellan (1975, 1987) native copper was heated and pounded with rocks. Large knives and arrow points were the most common objects made of copper. The Southern Tutchone used long copper knives that were attached to shafts as a weapon against people and for hunting bear (McClellan 1975). Copper was recognized not only for its technical qualities but was also thought to "keep the body pretty good" (McClellan 1975:256). Copper objects were worn to guarantee health and during a young girl's puberty confinement she might keep copper pieces in her mouth to insure strong teeth in old age. Southern Tutchone and Inland Tlingit both described the use of "copper neck bands" (McClellan 1975:318). McClellan also states that "all three tribes" (the Southern Tutchone, Inland Tlingit, and Tagish) wore bracelets, which "were highly valued in earlier times" (McClellan 1975:319).

While at Fort Selkirk in 1891 in Northern Tutchone territory, Schwatka (1996:129) observed the use of copper by Natives for items such as bullets, arrow-heads, and a "long copper spatula" used to get the marrow out of moose and caribou bones. The copper is presumed to have been native due to the Tutchone also having unworked pieces of native copper in their possession as well as "powdered azurite, or the blue carbonate of copper." This powder was used in the application of tattoos to the faces of women. Among these people Schwatka encountered the belief that striking a copper boulder with any tool would result in that person soon dying

(Schwatka 1996). Hayes (1892:144), a companion of Schwatka's, noted that the Natives had a "greatly exaggerated idea" of the value of native copper. This was also commented on by fur traders on the Northwest Coast in the eighteenth century (Emmons 1991).

Though he did not visit Kletsan Creek, Glave (1892) traveled through Tutchone territory the same year as Schwatka, 1891. He commented that bone, copper, and iron were all used for arrow points. Glave (1892:877) indicates that some of the native copper that reached Euroamerican traders on the coast of Alaska showed "signs of having been hacked off a solid block." The Natives (presumably Tutchone) Glave met on his trip described large rich deposits of copper asserting that the bases of mountains had boulders of native copper from which they "chopped off all they needed." Glave did not believe these accounts but did see many nuggets of native copper among the Natives that were "carried for repairing purposes". He also noted a piece of it "strapped around the bowl" of an old man's pipe in addition to its use for projectile points (Glave 1892:877).

A Tutchone clan belonging to the Wolf moiety had a house known as Drum Sound House that was also referred to as Copper House. Another clan, the Champagne *ganaxtedi*, considered the Drum Sound House to be their main lineage and the highest ranking individual at the time held the name "Copper Master" in Tlingit. The name refers to a copper door that a lineage ancestor purchased from people in Dry Bay (McClellan 1975).

A Tutchone story indicates that it was from them (Athapaskans) that the Tlingit learned of copper. A Tlingit man traveled up the Alsek River where he encountered the Tutchone. He stayed and married into the group and taught them many things, but was in turn shown native copper, the first he had seen. When this man returned to the coast with his new relatives, they were turned away by the first Tlingit clan they encountered. This clan was known forever after as being unlucky, presumably due to having missed out on the opportunity to trade for copper. In recent times an unlucky Tlingit individual might be referred to as "He sent the Athabaskans away" (McClellan 1975a:27).

As a boy, Albert Isaac, a Southern Tutchone from Aishihik, was told of the origin of copper by an individual known as the Copper Chief. Long ago a man had two picks, one of iron and the other of copper. He used these picks to climb a wall of ice on a mountain now known as Mt. Natazhat (Figure 4.1 #15), which is just south of the Kletsan Creek headwaters. When he reached the top he could not climb back down because the steps he made using the picks had become smoothed over again. He threw the iron pick towards the coast and the copper pick further inland saying "Be copper on this side!" and sat on top of the mountain until he turned to stone. This story explains why Native people on the coast had iron and Native people of the interior had copper. The man who turned to stone on Mt. Natazhat could still be seen according to some (McClellan 1987:56). Cruikshank (1990) recorded a story from a woman of Tagish and Tlingit ancestry in southern Yukon that mentioned a giant copper-clawed owl that lived in a glacier and was a danger to people.

Chugach

At the time of Euroamerican contact the Chugach Eskimo territory included Prince William Sound and the outer coast of the Kenai Peninsula around to Kachemak Bay (Figure 1.2) (Clark 1984). Chugach is one of two dialects of the Pacific Yupik language (also known as Sugpiaq or Alutiiq); the other dialect is Koniag spoken on Kodiak and Afognak Islands and part of the Alaskan Peninsula (Woodbury 1984). According to de Laguna (1956) there were at least eight local groups within Chugach territory and each associated with a major settlement and its own chief. Subsistence was focused on the ocean. Marine resources such as seal, sea otter, whale, herring and other salt-water fish, and sea birds were obtained using kayaks (one to two man boats) or umiaks (larger boats), salmon were also caught in streams. The littoral environment provided numerous shellfish species (Clark 1984).

There were several copper mines in operation in Prince William Sound during the early part of the twentieth century (Lethcoe 1990). De Laguna (1956) listed several sites in Prince William Sound where native copper was reportedly found (Figure 1.2 and Table 4.2): the Bonanza Mine on Latouche Island, the head of

Landlocked Bay in Port Fidalgo, between the town of Cordova and the former community of Orca, and 16 kilometers northeast of Orca. According to an informant of de Laguna's, when the mine on Latouche Island first opened "stone mining tools" were recovered from the location (de Laguna 1956:5). Another of de Laguna's informants told of the Chugach obtaining copper from behind a waterfall somewhere near Garden Cove. The Chugach name for Garden Cove, *kan · ualk*, means "copper place" (de Laguna 1956), written *Kanawalek* on a Chugach Place Names poster (Chugach Alaska Corporation 2003). The Chugach Place Names poster also shows *Kanuwalem Kuiya*, "creek of one that has copper;" flowing into Garden Cove (Chugach Alaska Corporation 2003). This last place name can be found on the digitized U.S.G.S. topographic map sheet Cordova B-7 (U.S.G.S. 1997) (Figure 4.1 and Table 4.1).

In 1787 Cook (in De Laguna 1956:61) commented on the Natives of Prince William Sound being in possession of "spears or lances" tipped with iron or copper and that these two materials seemed to be in abundance. Despite the presence of native copper in Prince William Sound, the Chugach also acquired it from the Ahtna. According to the Ahtna, obtaining copper was one of the reasons why the Chugach conducted raids into their territory (de Laguna and McClellan 1981; McClellan 1971). Apparently, the Chugach also traded with the Ahtna for copper. Birket-Smith (1953) cites Sauer (1802) who said that the Chugach traveled 14 days up a large river (Copper River) in order to trade for copper tools including knives. A similar account is given by Tikhmenev (in de Laguna 1972) where the Chugach are said to have traveled for 20 days up the Copper River until coming to a place with many people where they traded for native copper that they also found for themselves. This latter part seems to refer to the collection of native copper from within Ahtna territory.

Birket-Smith (1953:72) indicated that though there was evidence of copper in Prince William Sound "it was mainly traded from the Ahtena…and was always cold-hammered." De Laguna (1956) was also told of the use of copper needles by a Chugach woman though none were uncovered during excavations. A Chugach

legend tells of two orphan boys who made a copper spear that they used to kill a brown bear that had killed their sister (Birket-Smith 1953).

Eyak

Linguistically, Eyak is related to Athapaskan in that they are both branches of the Eyak-Athapaskan language family. The Eyak formed two exogamous matrilineal moieties known as Raven, or Crow, and Eagle. Eyak territory in the eighteenth century included the shore of the Gulf of Alaska between Dry Bay to the southeast and Prince William Sound to the west, which were occupied by Tlingit-Athapaskans and Chugach Eskimo, respectively. "The Eyak formed four regional groups" (de Laguna 1990a:189) and two of these groups, those around Controller Bay and those between Capes Suckling and Yakataga, were being incorporated into the northwest expanding Tlingit community by the mid-nineteenth century. The Eyak were dependent on marine and river resources such as clams, seal, eulachon, herring, salmon, and other fish, but also hunted bear and mountain goat. Like other groups living on the Northwest Coast they had plank houses and permanent settlements (de Laguna 1990a).

Eyak material culture was similar to that of both the Tlingit and Chugach Eskimo "except for the greater use of native copper for knives, ulu blades, scrapers, pins, harpoon heads for arrows, or sharp arrowheads" (de Laguna 1990a:192). According to Abercrombie (in Birket-Smith and de Laguna 1938), the Eyak were still using stone and native copper tools in 1884. "Both men and women used long, double-edged copper daggers, which they obtained in trade from the Copper River Indians. These had a blade with three beveled surfaces on one side, the other side being flat; the handle was wound with skin and ornamented with two ear-like spiral projections" (1938:75). Abercrombie (in Birket-Smith and de Laguna 1938) also mentioned the use of copper for finger rings for both men and women and a shaman was described as wearing similar rings in his hair. These copper rings were made by bending thin bands. Fine-grained sandstone was used for sharpening copper blades (Birket-Smith and De Laguna 1938). Copper was also used for personal adornment such as finer rings, hair rings, bracelets, and ear and nose ornaments (Birket-Smith

and de Laguna 1938; de Laguna 1990a). At times, the Eyak would act as middlemen for the Ahtna, taking their copper to the trading post at Nuchek in Prince William Sound (Birket-Smith and de Laguna 1938).

Tlingit

Speakers of the Tlingit language are territorially associated with the Alaskan panhandle. The Tlingit can be divided into three major linguistic groups, the Gulf Coast, the Northern Tlingit, and the Southern Tlingit. This section will deal mainly with the Gulf Coast and Northern Tlingit. Tlingit territory includes the rugged coastline of the mainland and islands from Dixon Entrance to Icy Bay. Frederick Sound roughly demarcates the Southern from Northern Tlingit (de Laguna 1990b).

The Gulf Coast people are the descendants of Hoonah and Chilkat Tlingits who intermarried with and absorbed Athapaskan and Eyak groups as they expanded northwest along the coast of the Gulf of Alaska. This process took place during the eighteenth and nineteenth centuries. The Northern Tlingit include the Hoonah, Chilkat-Chilkoot, Auk Taku, Sumdum, Sitka, and Hutsnuwu qwans. The Tlingit made up two exogamous moieties, Raven and Eagle (Wolf in the south) that were composed of several matrilineal clans. Qwans represent a regional grouping of several different clans that intermarried with one another. Though there was local variation in available resources and several species of land mammal were exploited, marine and littoral resources dominated Tlingit subsistence. River runs of salmon were especially important (de Laguna 1990b).

The use of copper on the Northwest Coast in general has received a great deal of attention largely due to three factors. First is the existence of large shield-shaped copper objects, *tinná* in Tlingit, often referred to as Coppers, which were circulating on the Northwest Coast very early in the fur trade (de Laguna 1972). For a detailed study of these objects see Jopling (1989). De Laguna noted that of the 135 Coppers known from museums (Emmons 1991), at least 125 of these have been subjected to metallographic examination confirming that they were made of non-native, commercially produced, industrial metal (Couture and Edwards 1962, 1963; Jopling 1989; Wayman *et al.* 1992). Second, native copper artifacts occur in burials

from Prince Rupert Harbour that date as early as 2565±60 BP (cal. 1020 BC - 800 BC). This is the earliest known occurrence of a native copper artifact on the Northwest Coast (Ames 2005) and in northwestern North America. Third, on the Northwest Coast native copper has been associated with the expression of social complexity, *i.e.* prestige, high status, or rank (Ames 2005; Ames and Maschner 1999; Blake 2004; Drucker 1943; de Laguna *et al.* 1964; Hayden and Schulting 1997; Tybjerg 1977).

Sources that mention the use of copper by the Tlingit are sometimes ambiguous with regards to whether native copper or Coppers are being discussed. Much information pertaining to the Tlingit use of copper refers specifically to Coppers. In some cases, especially origin stories, native copper and Coppers seem to merge. An inventory of Tlingit archaeological sites in Alaska where native copper or potentially native copper artifacts have been recovered is provided in the following section. An inventory of all archaeological sites in the Northwest region with native copper artifacts as well as a discussion of metallurgy for the entire Northwest Coast region are both outside the scope of this thesis. A more detailed description of Coppers will be presented in Chapter 8 within the context of a discussion of the value of both native copper and Coppers. For a review of the supernatural and symbolic aspects of native copper and Coppers for the entire Northwest Coast see Jopling (1989). For a more general discussion of metallurgy on the Northwest Coast see Acheson (2003), Rickard (1939), Wayman (1993), Wayman *et al.* (1992).

The Tlingit term for the shield-shaped Coppers was *tinná*, but the Tlingit word for the material itself was *e-ak* or *ik* (Emmons 1991) (*'eq* Boas 2002). *Ik-yatze* or *Ik-yatz*, meaning "dark copper," was the term used for both "old weathered" copper and iron (1991:177). Iron was evidently considered a darker and harder kind of copper. According to Emmons (1991) the Tlingit referred to the modern day Copper River (*i.e.*, not the Chitina River) as *eek heene* or *e-ak heene*, meaning "water of copper."

Though the more northern Tlingit (Yakutat, Chilkat, and Chilkoot) are said to have had a monopoly on the trade in native copper, they credited the Ahtna with

both discovering, and learning how to work it (de Laguna 1972). According to information collected by de Laguna *et al.* (1964), the Yakutat Tlingit obtained native copper in trade from the Ahtna. The first copper in Yakutat Bay was said to have been brought there by the Kwackwan sib, who were Ahtna who emigrated from the area around the confluence of the Chitina and Copper Rivers. Because copper was so highly valued, it was only worn by the "rich and noble" (de Laguna *et al.* 1964:87) and people said that their ancestors were able to make copper "hard as steel" (de Laguna *et al.* 1964:88). One route by which native copper arrived on the coast from the Chitina River was over mountains and ice fields and down the Duktoth River east of Icy Bay. The copper was traded in the form of "rough bars" and an informant of de Laguna's (1972) suggested that the copper was beaten to shape by people on the coast.

De Laguna (1972) describes the use of copper for bracelets that were each worth a single sea otter skin. Necklaces were also said to have been made of "twisted copper" (de Laguna 1972:445). A bracelet made of copper wire twisted around iron was found in a shaman's grave near Yakutat. Based on archaeological specimens from the Old Town site in Yakutat Bay (de Laguna *et al.* 1964), de Laguna believed they were "cylindrical spirals of copper, strung like beads" (1972:445). A specimen from the Old Town site resembles a coiled spring. When shown a tubular piece of native copper from the Old Town site that contained a piece of root in the hollow, one of de Laguna's (1972:664) informants explained its use as an amulet:

> Some old people got their dope in there - the roots they believe are lucky. Sometimes they use it for hunting sea otter. Sometimes before they eat, they use it. We don't use it much [now], but we hear about it. This time we believe in God, but I hear about it. It [the copper tube] is just to keep it [the root]. They tie it up and make a wish for luck…Because copper cost so much, they use a little of that. There's lots of things they save out of this to make money on.

Based on this information de Laguna (1972) believed that a small piece of copper was used to attract a larger piece.

De Laguna (1972) describes a woven hat with crest designs in the Portland Museum that once belonged to a Chief of the Teqwedi clan in Yakutat. The hat has six cylinders on the top, three covered in hardwood and three covered in copper; the latter is most likely not native copper. The three copper rings were said to be worth two slaves. De Laguna (1972:692) also provides descriptions of masks that incorporate pieces of copper but it is uncertain as to whether these examples use native or trade copper.

Copper was reportedly used for ulu-style knives (semi-circular with curved cutting edges). Such a blade might be inserted into a wooden handle for use or used without hafting with the back part of the knife folded and hammered over (de Laguna 1972). In 1786, La Pèrouse (in de Laguna 1972:116) commented on the presence of both iron and copper, especially knives, among the Tlingit at Lituya Bay. This location was reportedly a stopping place for more southerly Tlingit on their way to Yakutat to trade for native copper. The more elaborate metal knives were made of trade copper or iron (Wayman *et al.* 1992; Wayman 1993).

Speaking on the Tlingit use of native copper, Abercrombie (1900:395-396) wrote, "Years ago coffee bowls, often of immense size, beaten out from native copper, and knives from the same source, highly valued, were in use among the Yuktats and Chilcats, but have since been superseded by those of other material." Native copper was also used for small nails in manufacturing a box found during excavations at Old Town (de Laguna *et al.* 1964).

Emmons (1991) discusses the use of copper and brass wire to make bracelets. These bracelets were made by twisting two strands of metal into an open ring. Another form of metal bracelet was a broad band with either etched animal designs or shell inlay. This form was supposedly more valuable than the former. Emmons (1991:178) notes there were "heavy rounded bracelets and anklets of copper" that were trade items and not indigenous. Additionally, "heavy neck rings were worn upon ceremonial occasions and were indicative of rank and wealth" (Emmons 1991:178). Though Emmons' (1991) statements concerning "heavy" bracelets implies that these neck rings were made of trade metal they were noted by early explorers (Bodega and Mourelle in 1779 at Bucarelli Bay, La Pérouse in 1786

at Lituya Bay, and Beresford [with Dixon] in 1787 at Sitka and the Queen Charlotte Islands, all in Emmons 1991:178). Furthermore, a specimen purchased by Emmons at Nass Harbour in 1906 was subjected to chemical testing and determined to be made of native copper.

In discussing the working of native copper Emmons (1991) mentions the use of heat and beating with stone hammers to increase hardness. He states that "artificial tempering was unknown" (1991:178) but noted that the Tlingit "claim to have tempered it by dropping it when hot in old urine which was strong [as a result of having]... been allowed to stand for some time." Witthoft and Eyman (1969) discuss the Tlingit practice of using fish oil to make metal surfaces resistant to corrosion. Among the Chilkat Tlingit, copperworking knowledge was kept secret (McClellan 1975). A Chilkat woman was credited with the invention of forging and according to Holmberg (1985:16), commenting on the situation in the late nineteenth century, "even now many conserve this art as a secret and it is passed on in certain families as an inheritance."

Emmons (1991) believed the copper trade to have been started by either the Chilkat or Hoonah. He also cited the Copper River source as the "principal source of supply for the coast as far south as Vancouver Island" (1991:177). A Hoonah story credits the introduction of copper to the Tlingit to a man named *Ka-kakh-ta* living near Cape Spencer. Because this man killed the spirit of sleep that appeared in the form of a bird his entire village died. Left alone the man wandered up the coast to Dry Bay and then up the Alsek River until he met people (presumably Tutchone Athapaskans). He taught the Athapaskans the Tlingit way of hunting, fishing, gathering, and preparing food. It was with these people that he first saw copper. It was being used for knives, arrowheads, spears, and the shield-like Copper. When he left he was given some, which he took back to Tlingit people thus starting the coast-interior copper trade (Emmons 1991).

Elsewhere Emmons (1991) indicates that it was the Chilkat at the head of Lynn Canal that began the trade in copper with Athapaskans in the interior. Nuggets of native copper were carried back over long distances during trips made to trade for fur. The copper obtained by the Chilkat came from Kletsan Creek.

Furthermore, according to Emmons (1991) this source of native copper was being exploited by Tlingit people prior to the use of the Copper River source because the Chilkat in Lynn Canal were trading with the interior before the Yakutat region was settled. With regards to the availability of copper on the coast Emmons (1991:178) noted it "was never very abundant and increased in value as it was traded southward."

The Chilkat and Chilkoot Tlingit were obtaining native copper from the Tutchone as late as the mid-nineteenth century. Though the Tlingit were most interested in furs, trading them to Euroamericans at a considerable profit, they obtained other items in trade from the Tutchone including native copper. It would appear that they were trading for native copper even though they had access to trade metal from Euroamerican fur-trading vessels. Indeed, the Tlingit seem to have been trading industrial copper metal in the form of kettles to the Tutchone while simultaneously receiving native copper (Legros 1984).

There are several Tlingit stories regarding the origin or existence of copper. De Laguna (1972) collected a version of the Salmon Boy story that is set in Sitka. A boy complaining of hunger throws away some moldy fish given him by his mother. He goes to the beach to catch seagulls and ends up drowning and being taken to live with the fish. From the fish (salmon) people he learns the proper behavior and attitudes that humans must display towards fish and eventually returns to his village. From the water he sees his mother cutting fish but when he attempts to talk to her his father kills him with a spear. When his father cuts off his head to begin cleaning the fish he notices that it is wearing a copper necklace and the parents recognize it as their son. The boy's parents find a way to bring the boy back to life as a human. In other versions of this story the copper necklace is what saves the boy from being killed.

Another story from Sitka collected by Swanton (1909:257-261) concerns the origin of copper. This story is related to the story of the girl who married a bear. The girl in this story eventually runs away from the bear people and marries sons of the sun. She has a child fathered by them but they eventually ostracize the mother and child. The mother and child return to the village of her father, a chief, but are

not welcomed back and must build themselves a brush house at the far end of the community from her father's house. The mother and child were the subject of scorn. People threw garbage onto their brush house and referred to the boy as garbage man. The mother made a bow and arrow that her son used to hunt. Once while at a lake he had visited previously, something with a red mouth moved rapidly towards the boy who had now grown into a young man. It was an animate canoe and it made a sound like a raven when the young man shot an arrow into its mouth. The canoe was made of copper and broke into pieces. The young man carried the pieces back to the brush house and used them to construct a house that was hidden underneath the brush. He then pounded spears, bracelets, and copper plates (Coppers) in the copper house hidden beneath the brush. He positioned the plates around the inside of the house. People in the village continued to throw garbage on the brush house and refer to the boy as garbage man. Though they could not see what was going on in the house they also referred to him as pounding chief due to the noise he made working the copper. In the village there was a chief's daughter who was unmarried due to the difficulty in finding her a suitable match. The young man went to her at night with a piece of twisted copper. He poked her with the copper roll through a hole in the house wall. The woman grabbed the copper and smelled it but did not know what it was. The young man then got her to come outside and follow him to his house copper house. The copper shone in her face and they were then married in the copper house. Later, people in the village began to look for the girl. When the woman's family found out their daughter married the low status garbage man they ran to his brush house and kicked it. When the copper house was exposed the young woman's family was shamed. The young man later gave the chief eight coppers because he had married his daughter. Then they cleared away the brush and let the copper house shining. The young man's father (related to the sun) shone on the copper in order to help his son. The story ends with a comment from the narrator regarding the high value accorded copper including a statement that "even lately a copper plate used to cost two slaves" (1909:261).

A copper origin story concerning the Kwackwan (de Laguna 1972) was presented earlier in the Ahtna section. Another story concerning the Kwackwan and

copper, collected by Swanton (1909:347-368), will be presented here as it deals specifically with the migration of Ahtna people (the Kwackwan clan) to Yakutat Bay. In this version of the story, as with other stories about the migration of the Kwackwan, there was a dispute over the inheritance of a deceased chief's property. Though descriptions vary the item in question is reported to have been a dish that was visually striking. In the version collected by Swanton (1909), the deceased chief also had a Copper but this seems not to have been fought over. Because of the dispute the Kwackwan clan, numbering 40 individuals, left and traveled to the coast. The migration to Yakutat Bay took approximately ten years during which time the group stayed for some time in Icy Bay. After ten years a man sent six of his nephews (all brothers) along the shore in a canoe to look for people. They reached Yakutat Bay and found Athapaskan people living there but the newcomers were not welcomed but instead sent away. The brothers returned to their uncle who then sent them on another trip. This time the brothers were sent to retrieve a large piece of copper, referred to as a "plate" and probably either a Copper or large nugget, from their homeland in the interior. The copper was reportedly in a valley that led down to the Copper River. The uncle did not want to leave it there any longer because it was valuable. The brothers found the copper and it was long and had eyes. They cut the copper down the middle into two pieces and carried it back to the coast. The people at Icy Bay then went to Yakutat with the copper. Once again the people already living there tried to send them away and would not allow them to fish in a stream called *Kack!*. At this point the newly arrived Kwackwan used the copper, valued at ten slaves, to buy the stream, thus ending the dispute.

The Trade and Exchange of Native Copper and the Control of Sources

Colonel Abercrombie, who made two expeditions up the Copper River in 1884 and 1898 (but only succeeded in reaching Ahtna territory in 1898), believed that "most of the trade between the interior [Ahtna] and Nuchek [trading post in Prince William Sound] was modern" (Birket-Smith and de Laguna 1938: 150). According to Abercrombie, Nicolai, the Ahtna chief at Taral, began sending copper

to Nuchek with his "second-in-command" after learning that the Russians wanted copper for manufacturing bolts for the ships being constructed (most likely in Sitka). Birket-Smith and de Laguna (1938:150) were quick to note that though the Russian demand "must have been a great stimulus," the movement of native copper from the interior to the coast pre-dated the Russian fur trade. This assertion was later supported by the recovery of native copper artifacts by de Laguna from prehistoric sites in Prince William Sound (1956) and Yakutat Bay (de Laguna *et al.* 1964).

A former trade route went from the interior to what is now Valdez through the Keystone Canyon of the Lowe River and then across the Sound to Nuchek. A trail was found by Abercrombie up the canyon and across to Tiekel in the Copper River valley. Abercrombie also found a shell midden at the mouth of the Lowe River near Valdez and speculated that this may have been the site of an Eskimo village strategically positioned to control the movement of copper to the coast. He also believed that the village of Alaganik was founded in order to take advantage of the copper trade, though after the 1868 measles epidemic (Birket-Smith and de Laguna 1938). According to Birket-Smith and de Laguna (1938:151), "the Copper River Natives never went to Nuchek but paid a commission to the Eyak for delivering their copper to the trading post and bringing back trade goods in exchange." However, this may not have always been the case as other sources indicate.

Early on in the period of Euroamerican contact several different Athapaskan groups (Northern and Southern Tutchone, Han, Upper Tanana, and Ahtna) attempted to exert control over the native copper sources of both the White and Copper Rivers and the flow of Euroamerican trade goods into the region (McClellan 1981). This struggle resulted in two individuals controlling the flow of native copper out of the region by the late nineteenth century. The Southern Tutchone individual known as Copper Chief controlled the movement of White River native copper to the south and east. Chief Nicolai, the Lower Ahtna leader residing at Taral controlled the Copper River trade (de Laguna and McClellan 1981).

The Ahtna have been widely credited with holding a regional monopoly on the trade and exchange of native copper (de Laguna and McClellan 1981; Reckord 1983; Wrangell 1970). More specifically, this monopoly was under the control of the Lower Ahtna and in the 19th century associated with a single individual, Chief Nicolai (de Laguna and McClellan 1981). The Lower Ahtna lived nearer the coast and not only were there many separate localities within their territory where native copper could be procured, they also had direct access to coastal (*i.e.*, Tlingit) trading partners. Despite having access to nearby sources of native copper, Chief Nicolai showed Lieutenant Allen copper bullets (slugs) in 1885 that were obtained from Natives "over the mountains," meaning, the Tutchone at the head of the White River (Moffit and Maddren 1909:19). Despite claims of an Ahtna monopoly, other groups had sources of native copper within their own territory. In addition, groups such as the northern Tlingit may have monopolized the southward trade of native copper though they lacked direct access to it.

The Copper Chief, who lived near Snag along the White River, was known for his knives and spearheads made from native copper. These objects, as well as unworked copper nuggets were traded widely with much of it probably going to the northern Tlingit (Chilkat and Chilkoot) (McClellan 1987). Kletsan Creek, a tributary of the White River, was reportedly the main source of native copper for the Native people of southwestern Yukon Territory (Hayes 1892; Brooks 1900; Moffit and Knopf 1910). Legros (1984) reconstructed the trade between the Tutchone and Tlingit during the mid-19th century, aided in part by a diary kept by two Hudson Bay Company traders who lived in Tutchone territory from 1848 to 1852. Four separate groups, *kwans*, of northern Tlingit (representing three Chilkat and one Chilkoot villages) controlled access to passes through the mountains that led to Tutchone territory. These trade routes were carefully monitored and controlled through the use of force. The ownership of these trade routes rested ultimately with the upper class members of society (*i.e.*, elites, nobles, title-holders). By the mid-19th century (1848-1864) the northern Tlingit had regular access to Euroamerican traders via either Hudson Bay Company steamships that visited villages, or trips made to Russian-American Company facilities such as Fort New Archangel in

Sitka. During this period the Tlingit were trading the Tutchone finished Euroamerican goods such as muskets and copper kettles but were still obtaining native copper, in addition to furs, from the Tutchone (Legros 1984). For the contact period McClellan (1964, 1975) lists dentalium, Chilkat dance blankets, medicinal roots, and fish oil as well as trade goods such as pipes, beads, knives, mirrors, leaf tobacco, and tea as some of the items being traded into the interior. In exchange, the Athapaskans were trading native copper, tanned caribou and moose skins, tailored clothing, and furs to the Tlingit.

The northern Tlingit (Kan 1989), especially the Yakutat, Chilkat, and Chilkoot, had a monopoly on the trade in native copper on the northwest Coast (de Laguna 1972). These groups were in a position to control the southward movement of native copper from both the White River and the Copper River. Chilkat and Yakutat Tlingits traveled to the Copper River to trade for native copper (McClellan 1971). Yakutat Tlingit obtained native copper from the Copper River, and quite possibly from the White River via a trade route following the Alsek River. In exchange for native copper the Yakutat traded food items such as seal oil, dried seaweed, and dried berries. The Yakutat, and other Tlingit, traded native copper further south in exchange for prestige valuables, such as slaves and Haida canoes made of red cedar. This trade took the form of gift exchange and occurred between related individuals, generally through marriage, or fictive relatives designated to facilitate trade (Emmons 1991; de Laguna 1972). Emmons (1991) describes three routes by which native copper traveled from the interior to the coast: (1) down the Nizina, Chitina, and Copper River to its mouth; (2) from the Chitina River over the coastal range and glaciers to the coast west of Icy Bay; (3) from the White River to the headwaters of the Alsek River and down to Dry Bay; (4) from the White River to the headwaters of the Chilkat River and down to the shores of Lynn Canal.

Native copper from the Copper and White River region has reportedly been widely traded. According to Meares (in Keithahn 1964) the Nootka were observed to have "copper ore" acquired from the Tlingit. The Haida of the Queen Charlotte Islands obtained copper from the Chilkat Tlingit (Acheson 2003; Dawson in Brooks 1900). Schrader (1900) mentions Natives in the Cassiar District using native copper

reported to have come from the Copper River. Though the above examples provide evidence of the southward movement of native copper along the Northwest Coast, Doll (1898:143) mentions native copper among the Eskimo of Norton Sound that was obtained from "Indians of the interior."

The Upper Tanana (also known as Nabesna) obtained nuggets of native copper from the upper portions of the Nabesna and Chisana Rivers, and Kletsan Creek. They did not trade copper as extensively as did the Ahtna and Tutchone, both of whom had access to not only native copper sources but also direct access to coastal trading partners, but the Tanana did trade copper further into the interior to other Athapaskan groups such as the Han (McKennan 1959).

According to McClellan's (1971) Ahtna informants, obtaining copper was one of the reasons that the Chugach conducted raids into Ahtna territory. The Chugach also acquired copper via trade with the Ahtna and Eyak (McClellan 1971), with the Eyak acting as middlemen for the Ahtna (Reckord 1983). As mentioned earlier in the section on the Chugach, they evidently would travel up the Copper River to trade for native copper at a large Ahtna village, sometimes collecting it on their own (Birket-Smith and de Laguna 1938; Sauer in Birket-Smith 1953). As noted above, there were several copper mines operating within Prince William Sound during the first few decades of the 20th century and sources of native copper have been reported (de Laguna 1956; Lethcoe 1990).

Though there are reportedly deposits of native copper within traditional Dena'ina territory (Kari and Fall 2003), Osgood noted that "the Upper Inlet people often go to Copper River…to trade for native copper" (1937:75) and that "Copper knives are gained in trade from the Upper Inlet [meaning Dena'ina of upper Cook Inlet] people who in turn buy them from the Copper River people to the eastward" (1937:102).

According to Brooks (1909), Russian interest in the copper deposits of south-central Alaska began during the Bering Expedition of 1741. During a brief stop at Kayak Island, Steller saw copper tools being used by Natives. The Russians eventually sent a sergeant in 1796 from the Mining Engineer Corps up the Copper River to scout a way to Hudson Bay, establish contacts with inhabitants of the

Copper River, and search for copper deposits. Though he did establish friendly contact with the Ahtna he did not locate (*i.e.*, was not shown) copper deposits. Russian interest in the Copper River region and its copper resources continued. In 1797 Baranov wrote to Kuskov, the newly appointed chief of the Konstantinovsky Redoubt at Nuchek on Hichinbrook Island in Prince William Sound. Baranov's letter emphasized the importance of learning from the Ahtna (referred to by the Russian as Mednovsty, or coppers) where copper was found and how it was mined. Kuskov was advised to send an expedition to the Copper River in order to carry out a census, continue the search for copper deposits on the Chitina River and obtain more details about the upper Copper River. Additionally, Kuskov was to purchase native copper with beads, but not more than four *puds* (about 64 kg) because supposedly much effort was required to treat the copper for industrial use (Grinev 1993).

In the fall 1798 Kuskov sent Potochkin on this mission and he returned to Konstantinovsky Redoubt in the spring of 1799. He managed to visit several Ahtna communities but was unable to determine specific locations for native copper. That same year a *baidarschik* (low-level manager) by the name of Galaktionov was sent up the Copper River to continue the investigation of the Copper River and more specifically search for copper. During this expedition Ahtna leaders became increasingly wary of the penetration of their homeland by the Russians and the potential effect that Russian discovery of copper deposits would have on the Ahtna copper monopoly. Additionally, direct Russian contact with Natives on the upper Copper River would undermine the middleman benefits derived by those living nearer the coast from the fur trade. As a result of these fears, there was an attempt to kill Galaktionov as part of a larger plan to attack the Konstantinovsky Redoubt, but it was unsuccessful and Galaktionov, though wounded, managed to reach the coast. After lengthy negotiations Galaktionov returned to the Copper River in 1800. He still was unable to locate copper deposits but the Ahtna did bring copper to the coast to trade with the Russians. In 1803 Galiaktionov once again ventured up the Copper River but it would be his last trip as both he and his interpreter were killed by Natives who then went up the Chitina River. Grinev (1993) speculates that

Galaktionov may have finally discovered the location of native copper deposits and for that reason was killed. When Galaktionov started on his final trip in 1803 another Russian, Bazhenov, was also sent up the Copper River. On Bazhenov's trip an Ahtna Chief agreed to lead him to the copper deposits. This chief, however, ended up attacking Bazhenov and took back native copper in Bazhenov's possession. According to Bazhenov, the attack was a result of the chief's fear that the Russians would establish a settlement near the copper source (Grinev 1993).

Though no expeditions ventured up the Copper River in the following years, the Ahtna continued to bring furs, tanned moose hides, and copper to the coast to trade with the Russians in exchange for items of European manufacture. After the 1819 expedition of Klimovsky into the Copper River basin, Yanovsky, the Governor of Russian America, discouraged the continuation of attempts to exploit the Copper River. In a communication with the administrative board of the Russian American Company, Yanovsky expressed the opinion that additional attempts at exploration and the search for copper would not be profitable (Grinev 1993). After the U.S. purchase of Alaska in 1867 there was renewed interest in locating copper deposits in Ahtna territory but as late as 1898 these sources were still under the control of the Lower Ahtna (VanStone 1955).

Summary

Ethnohistoric sources for Alaska and the Yukon Territory provide a wealth of detailed information on the trade and use of native copper. In addition, these sources provide insight into the symbolic importance of native copper and its role as a source of wealth. Information on the indigenous use of native copper allows for a more contextualized discussion of native copper technology than would be possible relying solely on archaeological and archaeometric data.

Table 4.1 Indigenous copper place names and locations associated with oral history. (Corresponds with Map 4.1, pg. 59)

ID #	Place Names	Translation	Cultural Affiliation	Reference
1	Tesdi Ts'ese' Cae'e	copper stone mouth	Ahtna	Reckord 1983
2	Tsedi Kulaende'	where copper exists	Ahtna	Kari 1990, 2005
3	Tsedi Kulaende Na	where copper exists creek	Ahtna	Kari 1983
4	Tsedi Na	copper river (Chitina)	Ahtna	Kari 1990
5	Tsedi Cae'e	copper mouth (mouth of Chitina River)	Ahtna	Kari 1983
6	Tsedi Tu'	copper water (Chititu)	Ahtna	Kari 1983
7	Tsedi Ts'ese	copper stone (The Finn)	Ahtna	Kari 1990
8	Tsedi Ts'ese' Na'	copper stone creek (Chitistone River)	Ahtna	Kari 1990
9	Tsedi Ts'ese' Tates	copper stone pass (Chitistone Pass?)	Ahtna	Kari 1983
10	Tsedi Tl'aa	copper headwaters (headwaters of Chitina River)	Ahtna	Kari 1983
	Tsedi Ggalaaye'	copper mountain (location uncertain)	Ahtna	Kari 1990
11	Cuuyi Ak'ae (GUL-131)	Cuuyi's village	Ahtna	Gibson and Mischler 1984; Workman 1976
12	Tsetsaan' Na' (Chisana River)	copper river	Upper Tanana	Kari 1983
13	Klet-san-dek (Tsetsaan-digh?; Kletsan Creek)	copper creek	Upper Tanana/ Tutchone	Orth 1967
14	Eark-heene-nee	copper river	Tutchone/ Tlingit	Glave 1892
15	Mt. Natazhat		Tutchone	McClellan 1987
16	Tsedi Bak'ilani	the one in which there is copper	Dena'ina	Kari and Fall 2003
17	Tsedi Bak'ilanitnu	creek in which there is copper	Dena'ina	Kari and Fall 2003
18	Kanawalek	copper place	Chugach	Chugach Alaska Corp. 2003, de Laguna 1956
19	Kanuwalem Kuiya	creek of one that has copper	Chugach	Chugach Alaska Corp. 2003, U.S.G.S. 1997

Table 4.2 Ahtna terms for copper objects (Kari 1990:375-6).

Pre-contact	
tsedi k'a'	copper arrowhead
tsedi tsay'tsiy	copper knife
tsedi tseł	awl
tsedi ts'ighu'	snowshoe awl
tsedi 'aas bes	snowshoe lacing needle
tsedi sesi	copper snowshoe drill
tsedi biceni'aayi	copper axe
tsedi tsentseli	copper adze
tsedi tso'	copper pick, poker - "copper penis
tsedi saxi	copper gaff hook
tsedi didi'aani	copper nail
tsedi skaa	copper spoon
tsedi tutiił	copper cup
tsedi ts'aay	copper plate
tsedi lats'agh	copper ring
-enłnuude'	copper nose ring
bandeyaeni	spear with copper point associated with warfare and war chief
niłdzaats'aghi	copper knife (dagger) with fluted (voluted?) hand guards
Post-contact	
tsedi c'edziidi	copper bullethead
tsedi naz'aay	kettle/bucket
tsedi tsiniic	teakettle
Mythological	
tsedi lagets'	copper gloves
labaes	circular copper knife with sharpened edge resembling a discus

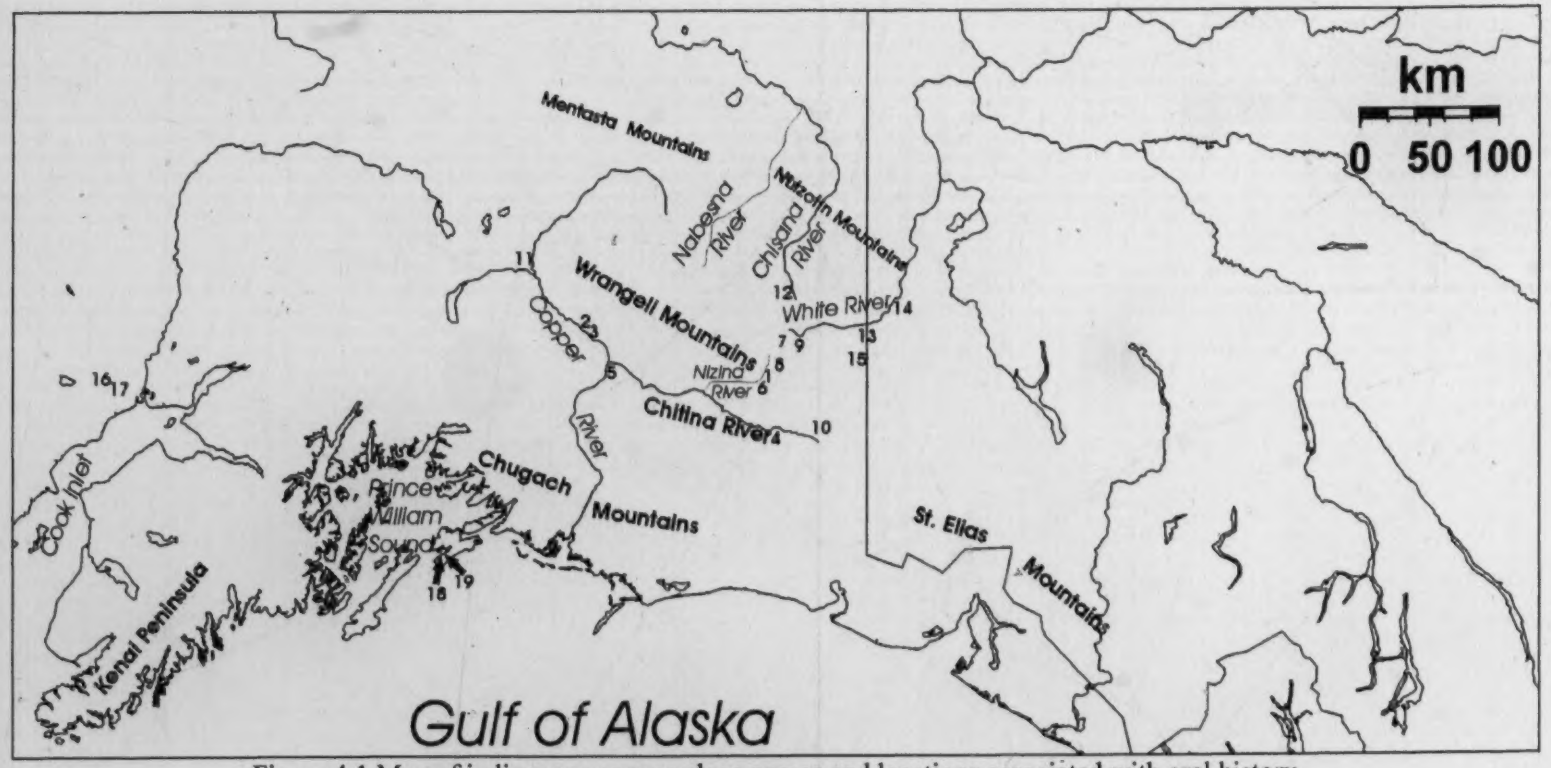

Figure 4.1 Map of indigenous copper place names and locations associated with oral history.

(Corresponds to Table 4.1.)

Chapter 5. Geological and Archaeological Occurrence of Native Copper

The information regarding the occurrence of native copper was derived from a review of both published and unpublished material. Unpublished material was obtained from the State of Alaska Office of History and Archaeology, Alaska Heritage Resource Survey (AHRS) and the Yukon Heritage Branch Site Files. The following sites have received various levels of investigation from numerous researchers over several decades. At the highest level of investigation are those sites where major excavation has occurred, although none of these have been completely excavated. Sites that have been partially excavated, or where intensive subsurface testing has occurred, represent the next level. Many sites are recorded based upon what is present on the surface and in a few cases, the site may be defined solely on an isolated surface find of a single native copper artifact. Site map locations are plotted using latitude and longitude coordinates from either published data or government databases. Detailed site location information is not provided in order to protect sites. Sites are denoted on maps by the capital letter "A" and a number, for example, **A1**. Maps in this chapter show the location of archaeological sites with native copper and the sources of native copper listed in Chapter 3.

The sites discussed in this section are limited to those having native copper artifacts or copper metal artifacts that may be native copper. Historic sites in the region with copper metal artifacts not suspected to be made of native copper are not included. In the following discussion, artifacts of copper metal will be referred to as being made of native copper if: (1) the original investigator of the site where the artifacts were found refers to the material as native copper, (2) I have examined the artifact(s) in question and determined through metallurgical or compositional analysis that the material is native copper, or (3) I found no reason to assume the artifacts in question are not native copper based on either visual inspection or literature review. When the type of copper metal material is in question (*i.e.* native or smelted pure copper or a copper alloy such as brass), the interpretations of the

original investigators will be provided as well any reasons for suspecting the accuracy of the original identification of copper metal material.

When multicomponent sites are discussed, attention is focused on the components or stratigraphic contexts related to native copper or other copper metal. The Periods used are Pre=Prehistoric, LPre=Late Prehistoric, Pro=Protohistoric, and H=Historic (Table 5.1). As will be discussed later, the use of the term Protohistoric is problematic. The term generally refers to the period of time when indigenous groups were receiving Euroamerican trade goods but were not in direct contact with Euroamericans, which defines the Historic Period. Archaeologically, the Protohistoric time period is indistinguishable from sites that date to the early contact (Historic Period). This is further complicated by the availability of iron by ca. AD 200 in Alaska via trade across the Bering Strait with the result that sites otherwise firmly within the Prehistoric period have materials often associated with the Protohisotric or Historic periods. Because the terms Protohistoric and Historic are defined on the basis of processes that occur at different times across the region under consideration, their use in Tables 5.2-4 conforms to localized chronology.

When available, radiocarbon dates are given that date the use of native copper or provide either a *terminus ante quem* or *terminus post quem*. Radiocarbon dates provided in the text are given as presented by the original author with some modification in an attempt to standardize in order to facilitate comparison of dates. The radiocarbon age is given first followed by a calendar age or age range, either calibrated (cal) or uncalibrated (uncal) in parentheses. The Associated Dates presented in Tables 5.2-4 are based upon the age provided by the original investigator according to a variety of evidence, including radiocarbon dates. Detailed information concerning the radiocarbon dates, including recalibration using CALIB radiocarbon calibration program Version 5.0, is presented in Table 5.14 at the end of this chapter. This chapter provides an inventory of archaeological sites with native copper, an overview of the regional distribution of native copper artifacts, a description of GUL-077 (the Gulkana site), a comparison of the native copper artifact inventories for GUL-077, TNX-004 (Dixthada), VAL-065 (Dakah

De'nin's Village), and YAK-007 (Old Town). The chapter ends with an overview of metallurgy and chronology in northwestern North America.

Inventory of Sites

Southwestern Yukon (Figure 5.1 and Table 5.2)

Several archaeological sites in the southwestern Yukon Territory where native copper has been found also contain White River Ash (WRA) deposits. Two separate lobes of ash fall have been documented in the region. Both likely originated from Mount Churchill, Alaska, approximately 30-35 kilometers south of the headwaters of the White River. The smaller lobe extends northward along both sides of the Alaska-Yukon border to the Yukon River. The larger lobe extends westward into the Mackenzie valley reaching to Great Slave Lake (Robinson 2001). It is this latter lobe that provides a *terminus post quem* for the occurrence of native copper artifacts at some sites and it has been radiocarbon dated to cal AD 803 (Clague *et al.* 1995).

A single fragment of copper sheet was recovered from JaUk-23 (A1) above the WRA and a copper awl was reportedly found at JbUn-1 (Greer personal communication 2005). A single piece of sheet copper was recovered during testing at JaUn-4 (A2), a prehistoric campsite that post-dates the WRA. The site consists of a hearth, flakes, and bone (Greer 1980; Yukon Heritage Branch Site Files 2005). Two pieces of copper were recovered from JbUf-2 (A3), a campsite consisting of lithic and bone scatter. Prehistoric and Historic period materials were found at the site, including trade beads. The site is considered to be Inland Tlingit. The copper is believed to be non-native due to the form of the sheets and the presence of other historic artifacts (Yukon Heritage Branch Site Files 2005). An artifact described as either an awl or perforator was reportedly recovered from JbUn-1 (A4) by MacNeish (Greer 2005 personal communication)

One small piece of copper was found at JcUj-12 (A5) along with lithics and faunal remains. The site falls within traditional Inland Tlingit territory (Yukon Heritage Branch Site Files 2005). A single copper projectile point was found on the surface at JcUw-3 (A6), which consists of a widespread surface scatter of lithics,

bone, and fire-cracked rock. The material is presumed to be prehistoric Tutchone (Yukon Heritage Branch Site Files 2005). A single "crude" tanged copper projectile point was found at JdVe-3 (A7), a campsite consisting of a hearth containing charcoal, ash, and calcined bone and a lithic scatter that included flakes and an obsidian endscraper. The site is considered to be Late Prehistoric Tutchone (Yukon Heritage Branch Site Files 2005). Native copper was found at JeUs-3 (A8) along with a hearth, flakes, bone, dentalia, and obsidian (Yukon Heritage Branch Site Files 2005). The details of the copper from the site are currently unknown. A single piece of native copper was recovered from JeVb-15 (A9), which consists of lithic scatter and nearby graves (Yukon Heritage Branch Site Files 2005). "Native copper sheet" was recovered from JfUv-7 (A10) but the details are currently unknown though it is listed in both the Prehistoric and Historic component inventories. The site was originally attributed to the Lake Laberge Band of the Southern Tutchone (McClellan 1975) and was probably a place where the Tutchone met with the Chilkat Tlingit to trade (Yukon Heritage Branch Site Files 2005). The site of JfVg-6 (A11) represents an isolated surface find of a fragment of copper that is presumed to be associated with the Late Prehistoric period (Yukon Heritage Branch Site Files 2005). A single "copper blade-like object" was recovered from JgVu-4 (A12), a multi-component site consisting of lithic and bone scatters, and FCR. The copper was found above the WRA and is attributed to the Aishihik Phase (1300-150 BP).

Two native copper artifacts are reported for JhVf-4 (A13). One specimen is a bipointed object with a wide flattened mid-section, the other is a fragment reportedly found at the site. The site is multi-component but the excavated copper is from above the WRA and attributed to the Late Prehistoric Aishihik Phase (Workman 1978). Four copper artifacts were recovered from excavations at JiVs-1 (A14). This is another multi-component site where copper is restricted to the post-WRA level. One specimen, found on the surface, is believed to be either a projectile point or a knife blade having a "broad thin blade and a tapering elongate rat tail." Two of the specimens are "tubes" (beads or tinklers) and the last is the tip fragment of an unspecified copper implement (Workman 1978:348).

A single piece of worked native copper was recovered from JjVi-1 (A15), an Historic Tutchone village. The site consists of house structures and materials eroding out of a sand dune including ground slate, glass beads, chi-thos (semi-lunar edge-chipped tabular slabs of coarse stone used to process hides (Workman 1978), and endscrapers (Yukon Heritage Branch Site Files 2005). The site of JjVi-7 (A16) has the largest collection of native copper artifacts in the Yukon. Workman (1978) recovered 15 native copper artifacts from the site but apparently copper was found here during an earlier survey (Yukon Heritage Branch Site Files 2005). All of the copper artifacts are from a post-WRA context. The artifacts include: a bipoint with expanded mid-section, two miscellaneous implements, an implement tip fragment, six rolled or bent sheet fragments, two thin sheet fragments, three other fragments (Workman 1978).

From JjVj-28 (A17) a possible copper artifact was reported along with a wood artifact (Yukon Heritage Branch Site Files 2005). Native copper was reported from KbTx-6 (A18) a multicomponent site. Though details as to number and form are currently unknown, the native copper came from the upper component (up to 200 years old) along with an iron projectile point and chi-thos (Yukon Heritage Branch Site Files 2005). A single "piece of beaten native copper" was found on the surface at KbTx-20 (A19), along with fire-cracked rock (FCR) in an area where flakes had been collected earlier (Yukon Heritage Branch Site Files 2005).

Eight copper artifacts were recovered from KbVo-1 (A20), a site consisting of lithic and bone scatter. Artifacts include: a microblade core fragment, hide scrapers (chi-thos), projectile points, a hammerstone, a Chinese coin, and native copper. The eight native copper artifacts consist of a projectile point and "artifacts and unmodified nuggets" (Yukon Heritage Branch Site Files 2005).

Five native copper artifacts were recovered during excavations at KdVa-8 (A21), a Late Prehistoric campsite consisting of hearths and lithics. The copper artifacts include a projectile point, a piece of sheet scrap, and three blanks. The latter are not rectangular, but have an asymmetrical curved form (Thomas 2003). Shinkwin (1979) describes similar forms from Dixthada and suggests they may be blanks for tools.

Two fragments of native copper were collected in 1993 during excavations at KdVo-3 (A22), a lithic and bone scatter site, along with unformed tools, projectile points, a microblade core, two hide scrapers, debitage, and faunal material. A radiocarbon date of 810±80 BP was obtained during work on the site at this time (Yukon Heritage Branch Site Files 2005) though the association between the copper and dated material is currently unknown.

A minimum of seven copper artifacts have been recovered from work at KeVe-2 (A23). This site formerly had two different Borden Site designations, KeVe-1 was the Historic trade post of Fort Selkirk, and KeVe-2 was applied to the indigenous occupation. The latter site code is currently used for all areas and periods of the site. The copper artifacts include: a projectile point and four sheet fragments found in 1988, and a projectile point and sheet fragment found in 2005 (Castillo personal communication 2005; Gotthardt and Easton 1989; Yukon Heritage Branch Site Files 2005).

An unspecified amount of native copper (possibly two artifacts) has been recovered from LaVk-10 (A24). The site consists of 113 historic features and two localities showing evidence of Prehistoric use. Material collected from the site includes: white beads, a copper piece, faunal bone, flakes, FCR, and iron. Copper was collected in both 1998 and 1999 (Yukon Heritage Branch Site Files 2005).

South-central Alaska (Figure 5.1 and Table 5.3)

The multi-component village site TNX-004 (A25) produced 44 artifacts of native copper in addition to iron, bone and antler points, microblades, bifaces, whetstones, hammerstones, flakes, scrapers, burins, and glass trade beads. The site falls within the Upper Tanana traditional territory and shows evidence of Late Prehistoric through Historic use (Rainey 1939b, Shinkwin 1979). The native copper was recovered from midden. Charcoal from the base of the midden produced radiocarbon dates of 390±50 BP (uncal AD 1560) and 770±40 BP (uncal AD 1180). Of the 44 copper artifacts from this site, 15 are considered debris while four (a bead, nose-ring, and two coiled objects one of which looks like a pin) are thought to be decorative (Shinkwin 1979). Subsurface testing on a point of land north of the

TNX-004 produced flakes and a copper artifact (A26) (Cook *et al.* 1971). This separate location was apparently never given its own site number.

Cook (1975) recovered a knife and awl made of native copper from XMH-205 (A27), a site with evidence of Late Prehistoric occupation in traditional Tanana territory. A copper bracelet was recovered during subsurface testing at XMH-242 (A28), a lithic scatter consisting of flakes and two chert bifaces. The site falls within traditional Ahtna territory (McKay 1981). A single small fragment of copper was found at HEA-062 (A29), in the Late Prehistoric component of the site. A radiocarbon date of 460±115 BP was obtained on charcoal from the hearth where the copper was found. The site falls within traditional Tanana territory (Plaskett 1977). Two copper artifacts, a cone and an unspecified piece, were recovered during excavations at HEA-189 (A30), a Prehistoric-Historic site. The copper, along with iron fragments and beads, were recovered from Component IV. Charcoal from a hearth in this component produced a radiocarbon date of 180±60 BP (uncal AD 1710-1830) (Betts 1987).

A fishhook reported to be native copper was found in a hearth diseovered during subsurface testing in 1996 at GUL-033 (A31) (DePew personal communication 2005). This location is a Historically occupied Ahtna village site that shows evidence of Late Prehistoric-Protohistoric occupation. The site consists of visible features such as house and cache pits and log structures and subsurface deposits of fire-cracked rock, bone, and trade beads with which the native copper artifact is believed to be associated (Cantley 1984, DePew personal communication 2005). A single piece of worked native copper was found among a scatter of lithics eroding out of the top of a hill at GUL-038 (A32). Both Prehistoric and Historic use of the site is evident (Irving 1957). The site falls within traditional Ahtna territory. An awl was recovered during testing at GUL-076 (A33), a Late Prehistoric Ahtna village site with house and cache pits (Clark 1974).

The site of GUL-077 (A34) has produced the largest collection of native copper artifacts, 170, to be addressed in this study. This Late Prehistoric-Protohistoric Ahtna site consists of campsites, cache pits, hearths, and one large house pit. Radiocarbon dating indicates that the majority of activity at the site took

place in first half of the second millennium, ca. AD 1150-1500 (Hanson 1999; Workman 1976). Three copper artifacts were recovered from GUL-079 (A35), a Historic (possibly Protohistoric) Ahtna site consisting of two house pits, four cache pits, and midden. One specimen was listed under the heading "Imported Goods" and one was described as "likely imported copper" (Ketz 1983:165). For the third specimen identification as imported or native copper was left undetermined. "Uniform thickness" was considered an important criterion in the determination of copper metal as an import (*i.e.*, trade copper as opposed to native copper) (Ketz 1983:154).

A single piece of hammered native copper was recovered from TLM-222 (A36), a Protohistoric Ahtna site consisting of a rectangular house depression and two smaller circular depressions (Dixon *et al.* 1985). At XMC-098 (A37), a single oblong piece of native copper was found on the surface and photographed in the field during recording of surface depressions. Another surface find of copper is from XMC-398 (A38), a surface lithic scatter near an obsidian source. The copper artifact is a tanged, triangular projectile point (Patterson 1998).

Another Ahtna site, Dakah De'nin's Village (VAL-065) (A39), at the confluence of the Chitina and Copper Rivers, has produced the second largest number of native copper artifacts in the region, 138. Shinkwin (1979) excavated two houses and trenched through a portion of a third at this site. Based on dendrochronology, the two excavated houses were dated to A.D. 1836-1838 (house #9) and A.D. 1816-1822 (house #2), though the use period of the houses most likely would have overlapped. Unlike houses 2 and 9, house #1 contained no non-native materials and may represent an earlier, late prehistoric occupation. Of the native copper artifacts, 114 were recovered from house #2 and 24 from house #1. Two trade metal artifacts, a copper alloy bell and iron spike, were recovered from house #9 but no native copper. House #2 also had iron (10 specimens) and glass trade beads were recovered from both house #2 and #9. Though the distribution of copper at this site shows a pattern not seen at GUL-077, there is a similarity in the small number of decorative items. Only two such items were recovered, both beads, and both from house #2 (Shinkwin 1979).

A single copper artifact, described as a "blank", was reportedly found at VAL-186 (A40). This Ahtna village site consists of several house pits and exposed cultural deposits at the edge of the river bluff. Beads were also reportedly found indicating that this may be a Protohistoric or Historic site (AHRS Site Files 2005). Another reported find nearby, VAL-187 (A41), consists of a single unidentified copper implement.

Two sites in Yakutat Bay have produced native copper, YAK-007 and -009 (A42 and A43, respectively). A single ulu-like knife blade was found in a test unit outside the cobblestone wall outline at the fortification site of YAK-009. These sites are related to the Late Prehistoric-Protohistoric use of the bay by Ahtna, Eyak, and Tlingit peoples (de Laguna *et al.* 1964; de Laguna 1972). Excavations at YAK-007 recovered 48 native copper artifacts. Two of these artifacts, both projectile points, were verified as being made of native copper through NAA (Veakis 1979). The site is a Late Prehistoric-Protohistoric village consisting of seven house pits, many smaller pits, and midden. In addition to copper, artifacts of bone, stone, wood, skin, and 19 pieces of iron were recovered. Two radiocarbon dates associated with the site date to 136±62 BP and 328±78 BP (Uncal AD 1552-1698). With regard to the younger date de Laguna *et al.* (1964) believed that the village was abandoned before the arrival of the Russians in the late eighteenth century. Furthermore, the Spanish explorer Malaspina (in de Laguna *et al.* 1964) commented on the village in 1791 but believed it to be uninhabited. The bay is presumed to not have been inhabitable until the late 15th or early 16th century due to glaciation (de Laguna *et al.* 1964).

Prince William Sound (Figure 5.2 and Table 5.4)

Native copper is associated with eight archaeological sites in Prince William Sound. Copper was reportedly found in the area of ANC-117 (A44). These artifacts, along with those from archaeological contexts, are presumed to be associated with Late Prehistoric Chugach occupation of Prince William Sound (AHRS 2005). Five copper artifacts were recovered by de Laguna (1956) during excavations at COR-001 (A45), an ulu-like blade, a rectangular pin, a ring, a barbed harpoon head, and a tanged, leaf-shaped projectile point. All of the copper artifacts are from the

uppermost part of the site. Four are from the uppermost stratigraphic layer referred to as Layer 4, and the projectile point was believed to be from either Layer 3 or 4 (de Laguna 1956). Radiocarbon dating of the upper portion of the site corresponding to de Laguna's Layer 4 produced dates of 430±40 BP (cal AD 1450) and 400±60 BP (cal AD 1470) (Yarborough 2000).

A single copper pin was recovered from SEW-056 (A46). The pin was found on a wooden floor that was radiocarbon dated to 295±90 BP (Yarborough and Yarborough 1989). For three, SEW-072, -077, and -078 (A47, A48, and A49, respectively) information regarding the copper was provided by an informant of de Laguna's in the 1930s (de Laguna 1956). The informant collected the material in question. Two "blade" fragments were collected from the beach at SEW-072, and a single projectile point from both SEW-077 and -078. De Laguna (1956) also recovered a copper projectile point from midden at SEW-081 (A50), along with adzes, hammerstones, mauls, lamps, and slate blades.

Two copper artifacts were recovered from SEW-488 (A51) and both have associated radiocarbon dates. A lanceolate-shaped blade was found a few centimeters below charcoal that was radiocarbon dated to 360±60 (cal AD 1435-1660). The other copper specimen resembles a knife blade and is bracketed by two radiocarbon dates on charcoal. The date obtained from above is 520±50 BP (cal AD 1315-1345 or 1390-1455) and the date from below is 560±70 (cal AD 1290-1455) (Yarborough 1997).

Cook Inlet and the Kenai Peninsula (Figure 5.2 and Table 5.5)

At the time of contact (ca. mid to late eighteenth century) the shores of Cook Inlet and adjacent interior were inhabited primarily by speakers of the Dena'ina dialect of Athapaskan (Townsend 1981), while speakers of the Pacific Yupik language, known as Sugpiaq or Alutiiq (Woodbury 1984), occupied the southwestern tip of Kachemak Bay and the outer coast of the Kenai Peninsula, Kodiak Island, and Prince William Sound (Davis 1984) (Figure 5.1). These last three geographic units were occupied by three distinct sub-groups, the Unegkurmiut, Koniag, and Chugach, respectively (Davis 1984).

A main concern of archaeological studies on the eastern side of Cook Inlet has been the attempt to reconstruct a regional cultural history that delineates the Dena'ina occupation from the earlier but over-lapping occupation of Eskimo peoples. Studies have shown there is no clear-cut geographic or temporal marker that clearly separates Athapaskan sites from Eskimo sites; instead there is geographic and temporal overlap (de Laguna 1975; Reger 1981, 1998; Workman and Workman 1988). Late Prehistoric occupation of the western Kenai Peninsula, which begins at around AD 1000, is believed to represent mostly the Dena'ina Athapaskans while the preceding 2,000 year period (1000 BC-AD 1000) represents occupation by Eskimo peoples, some related to the Kachemak tradition (Reger and Boraas 1996). The earliest occupation of Kachemak Bay dates to ca. 4500 years ago and has been associated with the Ocean Bay tradition. At around 4000 years ago bearers of technology resembling that of the Arctic Small Tool tradition made use of the bay and by 3000 years ago it was inhabited by people with clear connections to Kodiak Island, the Kachemak tradition, which persisted for 1500 years (Workman 1998).

Cook Inlet and Kachemak Bay show ample evidence of occupation by Eskimo peoples prehistorically and occupation by Athapaskans historically. The line between Eskimo and Athapaskan archaeology in Cook Inlet and Kachemak Bay becomes blurred around the beginning of the Late Prehistoric period (ca. AD 800-1200) (Reger and Boraas 1996) due to: (1) sites having both Eskimo and Athapaskan components (de Laguna 1975; Holmes 1988; Reger 1998; Workman and Workman 1988); (2) intrusive Chugach use of sites in Upper Cook Inlet after the arrival of Athapaskans (Reger 1998); and (3) the presence of components at many sites that lie between the Kachemak tradition and Historic Dena'ina but are not clearly attributable to either (Workman and Workman 1988).

The earliest finding of a copper artifact in an archaeological context in the region is attributed to Johan Jacobsen (1977) who excavated at a village site known by locals as Soonroodna in the late nineteenth century. This site was never relocated with certainty but it may have been one of the sites visited by de Laguna in the 1930s (de Laguna 1975). This site is not included in the inventory of sites with

native copper due to the uncertainty regarding its location. Jacobsen found a "small piece of copper that had probably been a knife" in the upper-most cultural layer at the site along with a blue glass bead, an iron knife, "lance points," bone harpoon points, and faunal material (1977:199).

Copper artifacts were found at three sites, ANC-036, -037, and -038 (A52, A54, and A53, respectively) on the northwest side of Knik Arm in uppermost Cook Inlet. A single fragment of sheet copper was recovered from ANC-036. Two awls, one still hafted, were recovered from ANC-037. The ANC-038 site produced a single piece of sheet copper in addition to lithic flakes, window glass fragments, and mica that possibly came from a metal stove. It is uncertain as to whether the sheet copper is native copper or industrial metal. The copper from ANC-036 and -037 is associated with Late Prehistoric-Protohistoric Dena'ina occupation though ANC-037 is a multi-component site believed to have been previously occupied by Eskimo peoples (Dumond and Mace 1968; de Laguna 1975).

A single piece of hammered native copper was found in the most recent component of ANC-054 (A55). This component also contained two hearths; one radiocarbon dated to 790±120 BP (cal AD 1257) and the other to 650±70 BP (cal AD 1296). These features are thought to represent Late Prehistoric use by Chugach Eskimo people (Reger 1998; Reger and Boraas 1996). The site ANC-268 (A56) is located in the Chugach Mountains at an elevation of 2800 feet. One tanged, lanceolate-shaped projectile point was photographed and measured by a state archaeologist but retained by the individual who found it (AHRS Site Files 2005).

Three sites, KEN-007, -020 and -028 (A57, A58, and A59, respectively), were reported by Kent *et al.* (1964) to have produced copper. KEN-007 produced beads, china, a piece of iron and "two small pieces of sheet copper" in addition to beaver teeth and other faunal remains (Kent *et al.* 1964:110). Two stone adzes were also reportedly recovered from the site. According to information collected from locals (Kent *et al.* 1964) an unspecified number of copper artifacts were collected from the other two sites. No information has been recorded regarding number, type, or context of these artifacts.

Three native copper artifacts were recovered from the multi-component site of KEN-066 (A60). The site contains the remains of both Eskimo and Athapaskan use. A tanged teardrop shaped projectile point, a bipointed pin wrapped in an unidentified fiber and a thin crescent-shaped ulu blade were all recovered from the upper levels at the site. The numerous radiocarbon dates on this level range from 895±85 BP (cal AD 1157) into the historic period. This level is presumed to be associated with Dena'ina occupation (Reger 1998; Reger and Boraas 1996).

Two copper artifacts were found in a house pit at KEN-094 (A62). The house pit dates to AD 1750-1800 based on a combination of radiocarbon dating and dendrochronology and is thought to represent a Late Prehistoric-Protohistoric Dena'ina occupation. One specimen is an awl, the other a piece of sheet with two holes in it, which may have been drilled. Iron was also found at this site (Holmes 1985, 1988). The sheet fragment may not be native copper. Four copper artifacts were also recovered from a nearby site, SEW-214 (A61). All specimens were found in the upper level of a hearth that was radiocarbon dated to 565±65 BP (cal AD 1310-1420). The copper artifacts include a spatulate-shaped object, a fragment of a similarly shaped object, and two flat fragments. One possible function offered for the spatulate-shaped object was use as a fleshing tool. Other artifacts found at the site include ground stone, flaked stone, iron, amber, shell, and faunal material. The site is presumed to represent a Dena'ina Late Prehistoric occupation (Holmes 1985, 1988).

A single native copper needle was recovered from the middle component of SEL-079 (A69). Radiocarbon dates from immediately above and below the middle component date it to around AD 1200-1600. This component is clearly separated from both the underlying Kachemak tradition component and the overlying Historic Dena'ina occupation. No cultural or ethnic label was applied to this component (Workman and Workman 1988).

Native copper has been recovered from two archaeological sites on Yukon Island in southwestern Kachemak Bay. De Laguna (1934) found five native copper artifacts at SEL-001 (A64). The five artifacts included a bracelet, a sickle-shaped blade, a blade fragment, and two cones (one of which contained a piece of rawhide)

(see de Laguna 1934: Plate 49-5,6,10,14,15). The two cones were interpreted as beads. All were from the uppermost layer (layer 10) of de Laguna's Yukon Island IV level. Along with copper, two small ceramic fragments were also found in layer 10. Neither copper nor ceramics were recovered from lower layers at the site. The underlying level of the site produced a radiocarbon date of 1369±102 BP (cal AD 653) (Reger and Boraas 1996).

Two native copper artifacts, a bracelet and piece of scrap, were found at SEL-041 in association with coarse gravel tempered ceramics. Radiocarbon dates place the main occupation of the site at around AD 600-1000 (Workman *et al.* 1980). It was suggested that the native copper may postdate the main occupation but no explanation for why this might be the case was offered (Workman and Lobdell 1979). This site is thought to represent a Post-Kachemak, pre-Dena'ina Athapaskan, short-lived intrusion of Norton-related peoples (Workman *et al.* 1980).

Southeastern Alaska (Figure 5.3 and Table 5.6)

A single copper artifact was recovered from SIT-135 and -244 (A66 and A67, respectively), both Tlingit fort sites with midden deposits (de Laguna 1960). Fort sites were defendable positions where people took refuge during attack and in some cases may have served as habitation sites for extensive periods of time (Moss and Erlandson 1992). The specimen from SIT-135 is a copper band wrapped around a piece of wood. It has what was thought to be a stamped design resembling an eye and was found at the bottom of the uppermost midden layer. The site was considered by de Laguna (1960) to be Prehistoric. A radiocarbon date of 668±86 BP was obtained from the site (Moss *et al.* 1989). The specimen from SIT-244 is a cone (or "tinkler"). The site is believed to have been occupied both prehistorically and historically (de Laguna 1960). Radiocarbon dates of 278±86 BP, 468±67 BP, and 905±103 BP were obtained from SIT-244 (Moss *et al.* 1989). The relationship of the radiocarbon dates to the copper artifacts is unknown.

Southwestern Alaska (Figure 5.4 and Table 5.7)

Townsend and Townsend (1961) excavated ILI-001 (A68) in Pedro Bay on Lake Iliamna that had prehistoric and protohistoric components. The later component included two fragments of iron, 15 glass trade beads, and two copper items. One of the copper objects is a button and the other is a flat rectangular piece with "four drilled holes" (Townsend and Townsend 1961:50).

Harritt (1988) recovered four copper artifacts from XMK-016 (A69) and three from XMK-034 (A70). These are sites that contain numerous house depressions that have yielded a variety of lithic and organic artifacts and demonstrate use from 1800 BC into the Historic Period. One of the XMK-016 objects was determined to be smelted metal based on metallographic analysis and is associated with the historic Pavik Phase (post-1800). The remaining material from both sites was recovered from Bluffs Phase (AD 1450-1800) contexts that had no Euroamerican trade items such as beads and are believed to be native copper. The historic object from XMK-016 is a piece of sheet copper. The native copper objects from XMK-016 include a small rod-shaped specimen with a rectangular cross-section and two fragments. These two fragments as well as one from XMK-034 were verified as native copper due to their relatively pure composition and large metal grain size. The other two specimens from XMK-034 are knives with the hafting still present (Harritt 1988).

Three copper artifacts were recovered from a house feature at NAK-015 (A71). The site consists of around 34 depressions and testing produced material associated with the Brooks River Bluffs Phase (AD 1450-1800) (Dumond 1981). Excavations in 1993 produced the three copper artifacts and no historic material. The copper came from House 65/67, which also produced pottery and four radiocarbon dates that fall within the Brooks River Bluff Phase (AD 1450-1800) (O'Leary 1999).

There are three sites on Kodiak Island associated with copper finds that may be prehistoric. A large copper "lance/spearhead" was reportedly found near KAR-023 (A72) according to an informant of Clark's (AHRS Site Files 2005). No other information is available concerning this object's provenience or whether it was made of native copper. A copper awl was recovered from the talus slope below

KAR-121 (A73) along with chipped and ground tools, flake and core tools, and cores. The site consists of artifacts and hearth features eroding out of a dune (AHRS Site Files 2005). A single copper artifact was recovered from the large Prehistoric and Historic village site of KOD-101 (A74). It is a "thin symmetrical copper blade" that is spatulate in shape and believed to be associated with Prehistoric Koniag occupation of the site (Clark 1974).

Northern Interior Alaska and Yukon Territory (Figure 5.5 and Table 5.8)

There are four sites in northwestern Alaska associated with Inupiat Eskimo that have copper artifacts that may be native copper. The HAR-001 site (A75) (Irving 1953) and XBM-009 (A76) (Giddings 1952) are both Late Prehistoric sites where fish-shaped fishing lures have been found with inlaid copper eyes. Irving describes one for HAR-001 and Giddings describes two for XBM-009. Giddings also mentions the use of copper for the barbs of fishhooks but it is uncertain as to how many of these were actually present. Irving infers the use of metal for fishhook barbs at HAR-001. Four copper beads were recovered from AMR-058 (A77). This site produced Protohistoric/Historic material including eight iron blades and 44 glass beads and was dated to AD 1840-1850 (Hickey 1976).

Seven copper artifacts have been recovered from XHP-00308 (A78). This is a multi-component site first excavated by Irving (1964), who found two of the seven specimens. One was a bracelet the other a flat, circular ring (bangle), Irving assumed they were Euroamerican in origin. Kunz *et al.* (2005) found an additional five copper objects in 2004 including: a copper bracelet, a piece of scrap, a U-shaped object, and two "bangles" similar to the one found by Irving. The two copper bangles were found in association with two pieces of iron and blue glass beads. Analysis of six of the copper artifacts confirmed they were made of native copper (Wayman and Cooper 2005). An AMS radiocarbon date of 470±40 (cal AD 1410-1470) was obtained on sinew wrapped around one of the copper bangles and blue glass beads. This material is probably related to Late Prehistoric-Protohistoric Inupiat occupation of the site (Kunz *et al.* 2005).

There are eight sites associated with Gwich'in Athapaskan occupation where native copper artifacts have been found. Three of these sites are in Alaska and the other five in the Yukon Territory. There is limited information on two other potentially relevant sites. A copper needle was recovered from a site near Galbraith Lake (A79) (Alexander personal communication 1962 cited in Hall 1969) and "tubular metal beads" were recovered from a stone house at Chandler Lake (A80) (Campbell 1963:578). Both sites are considered Athapaskan. A single awl was recovered from PSM-074 (A81). The site consists of hearths and bone and lithic scatters. A radiocarbon date of 310±140 BP (cal AD 1500-1780) is associated with the layer just above the layer from where the copper was recovered. The site is attributed to a Late Prehistoric-Protohistoric Gwich'in Athapaskan occupation (Wilson 1978).

Five sites along the Porcupine River in northern Yukon have all produced native copper artifacts. All of the site contexts with copper are presumed to be associated with Late Prehistoric or later Gwich'in Athapaskan occupation. One piece of copper was reported from both MhVf-1 (A82) and MjVk-7 (A84), and "lithic, bone and native copper artifacts" were collected from MjVl-6 (A86) (Franklin *et al.* 1981a; Yukon Heritage Branch Site Files 2005). Three specimens, a hook from a compound fishhook, a small pointed fragment, and a folded fragment, were recovered from the stratified site of MjVl-1 (A85), which spans the last 1000 to 1500 years (Morlan 1973).

Fourteen native copper artifacts were recovered from MjVg-1 (A83) including two projectile points, two awls, two worked pieces, a crescentic knife, and seven pieces of sheet debris. Twelve of the specimens were recovered from level 5 at the site, which has eight calibrated radiocarbon dates ranging from 340±90 BP to 1180±80 BP (cal AD 620-AD 1795). One of the pieces of sheet debris came from level 6a, below level 5, which has two calibrated radiocarbon dates ranging from 1510±80 BP to 2010±70 BP (cal 175 BC-AD 635). Reported date ranges are at the 2 σ level. The last native copper specimen was recovered from the beach below the site (Le Blanc 1984).

There are three sites within the traditional territory of the Koyukon Athapaskans where native copper artifacts have been recovered, MLZ-050, MMK-004, and NUL-010 (A87, A88, and A89, respectively). Two native copper artifacts were recovered from MMK-004, one piece of flattened sheet and one rectangular bar. They were both found in the bottom of the sod level in association with ironstone ceramic cup fragments. This material is probably attributable to a Protohistoric-Historic Athapaskan occupation (Holmes 1986). Both specimens were subjected to NAA and determined to be native copper (Franklin *et al.* 1981a). A single native copper awl was recovered during excavations at MLZ-050, an obsidian source site. Over 400 lithics were found at the site including cores, flakes, and tools such as bifaces, endscrapers, microblades, and hammerstones. A radiocarbon date of 1355±260 BP (cal AD 365-AD 885) was originally reported for calcined bone from the hearth. The Canadian Archaeological Radiocarbon Database web site provides a date of 1325±260 for this sample, which fits the reported age range. Though possibly contemporaneous the dated material was not obviously associated with the copper awl (Clark and Clark 1993). At least three copper artifacts were recovered from NUL-010. Ream (1986:524) describes a hammered copper nugget and a "half of a flat hammered copper circle" and "indicates" that a second copper circle also came from the site. The site is a village with at least 40 house pits showing evidence of prehistoric and historic occupation and has produced glass beads and iron.

Distribution of Native Copper Artifacts

Regional

Many different researchers, each of whom had different goals and resources, accomplished the recording of the sites reported above over a period of several decades. Native copper artifacts are found widely scattered throughout the Yukon and Alaska and would appear to be more commonly found in archaeological contexts in this region than along the Northwest Coast or the Central Arctic and Subarctic. Nevertheless, this review has made apparent that there are still relatively few sites that have native copper artifacts, especially when compared to the occurrence of native copper from archaeological contexts in eastern and Midwestern

North America. There are thousands of native copper artifacts from the latter region and much, but not all, (see Goad 1980 and Levine 1996, 1999) of this material is associated with the large native copper deposits of the Great Lakes (Martin 1999, Vernon 1986). One major difference between the use of native copper in eastern and Midwestern North America versus its use in Alaska and the Yukon is the longer period of use. Native copper was being used for making tools in the Great Lakes region as early as 6800 BP (Beukens *et al.* 1992), or earlier (Martin 1993), whereas the use of native copper in Alaska and the Yukon Territory seems to occur no earlier than *ca.* 1000 AD.

Of the 89 sites listed above: 45 had only a single specimen of native copper, 29 had 2-8 native copper artifacts, two had 10-20 (MjVg-1 and JjVi-7), two had 40-50 (TNX-004 and YAK-007), two had over 100 (GUL-077 and VAL-065), and nine have an undetermined number (see Table 5.9). Translated into a fall-off curve there is a steep drop off in native copper artifacts with distance from sources in south-central Alaska and southwestern Yukon Territory. However, the availability of native copper over such a wide area makes such an analysis less compelling. Most sites with native copper are in the supply zone and their inhabitants would have had direct access to this material. When native copper appears in sites whose inhabitants did not obtain native copper directly from the source (*e.g.*, YAK-007), it is most likely a result of trade with people who had direct access.

Only upon reaching the far north does the frequency of copper objects increase (XHP-308 and MgVg-1). Perhaps this is an indication that the native copper in use at these two sites was obtained through trade from somewhere other than south-central Alaska and the southwestern Yukon Territory (*e.g.*, Coppermine River region to the east). The site of YAK-007 is also noteworthy. This site has the largest number of archaeological specimens of personal adornment and is the only relatively large collection of native copper artifacts from a site whose inhabitants may have lacked direct access to native copper sources. This could be due to the site having been inhabited by Ahtna who moved from the Copper River region, trade with the Ahtna, or both (de Laguna *et al.* 1964; de Laguna 1972).

In addition to the relative rarity of native copper artifacts within Alaska and the Yukon, another major trend in the data presented here is the restriction of native copper to Late Prehistoric (800-1000 AD) or later, contexts. In southwestern Yukon, when native copper is associated with the White River Ash-fall, it always post-dates this event. This provides a terminus *post quem* for native copper in southwestern Yukon of 1147 BP (AD 803) (Clague *et al.*, 1995). Moodie *et al.* (1992) have suggested that the volcanic eruption which created the White River Ash-fall may have exposed native copper in the White River and Mt. Natazhat region, which led to its discovery and use. Though melting and outwash related to the volcanic event may have exposed copper-bearing gravels on Kletsan Creek, this event is unlikely to have affected the accessibility of the numerous native copper deposits in the region. However, the timing of the availability of native copper deposits in what is even today a mountainous region with numerous glaciers, is an interesting issue. Few archaeological sites are associated with native copper sources and no early sites have been discovered near native copper sources in the region. Perhaps the late use of native copper in the region is a result of sources being inaccessible in this mountainous glaciated region until recent times. Native copper may have been used relatively shortly after it was available and accessible on the landscape, as has been noted for the initial use of native copper in the Great Lakes region (Martin 1999).

Workman has discussed the use of native copper as a Late Prehistoric phenomena, noting that main occupation of GUL-077 dates to the first half of the second millennium AD (Workman 1976, 1977). There is little evidence for the use of native copper in the region prior to AD 1000. As a result of the appearance of native copper artifacts of similar form over a wide area within a relatively short time period (perhaps a few hundred years?), Workman (1978:344) suggests that it represents a "horizon technology." However, the relative scarcity of native copper artifacts within the region and its restriction to later prehistory limits the usefulness of the presence or absence of native copper technology in solving regional issues of chronology. Similarly, the association of native copper technology with both Athapaskan and Eskimo groups in Alaska prohibit its use in identifying the ethnicity of archaeological deposits without recourse to other forms of material culture.

Though the overwhelming majority of archaeological evidence places the use of native copper in the region no earlier than *ca.* AD 1000, there is one example in the region that may pre-date this period. The earliest use of native copper as witnessed in the archaeological record may be that of MjVg-1, Rat Indian Creek, in the northern Yukon. One of the pieces of native copper sheet debris came from a level that was associated with radiocarbon dates of 130 BC - AD 10 and AD 360-520 (Cal) (Le Blanc 1984).

GUL-077, The Gulkana Site

The following discussion compares the native copper technology found at the four archaeological sites in south-central Alaska that have produced the largest collections of native copper artifacts in the study area (Table 5.10). Because information on GUL-077 is not as readily available as it is for the other three sites, the following section provides a detailed but abbreviated description of the site. This description focuses on the native copper artifacts and their context as well as a reexamination of the native copper inventory. Newly calibrated dates for these four sites, in addition to being listed in Table 5.14, are provided in the text.

More native copper artifacts have been recovered from GUL-077, the Gulkana site (also Ringling site), than any other archaeological site in Alaska, the Yukon Territory, Northwest Territories and British Columbia. This large site formerly occupied a north-northeast trending bluff that stretched for about 1.7 km, near the community of Gulkana in the Copper River Valley of south-central Alaska (Figure 5.1 #A34 and Figure 5.6). Much of the site is now gone as a result of archaeological excavation and testing in the 1970s, 1980s, and 1990s and removal of large amounts of gravel in the 1970s. The site is believed to have been one of the "two old house sites…near Gulkana" investigated by Rainey in the 1930s. Both houses were determined to be prehistoric due to the absence of trade goods but few artifacts were found and none of native copper (Rainey 1939b:360).

Major salvage excavations were undertaken at the site in 1975 and 1976 under the direction of William Workman, then with Alaska Methodist University (Workman 1976). These excavations, performed to mitigate the impacts of mining

the location for gravel, located 54 features and recovered 559 artifacts including 142 of native copper. The land was purchased by the State of Alaska in 1980-81, after which additional surveys were performed prior to clearing other portions of the site for gravel removal (Gibson and Mishler 1984; Holmes and McMahan 1986; Stern 1983). Test excavations by the State of Alaska Office of History and Archaeology (OHA) in 1986 recovered three additional native copper artifacts, though only two are mentioned in the report (Holmes and McMahan 1986). Additional intensive testing of the site by the OHA took place in 1995 and 1996 resulting in the recovery of 25 native copper artifacts (Hanson 1999) bringing the total count for the site up to 170. An additional copper awl listed in the catalog from 1996 was not found. Artifacts of native copper were found throughout the site but were heavily concentrated in a few areas (see Figure 5.6 and Table 5.11 for feature locations producing copper and the number found). An additional 15 features or units had a single copper artifact.

The 1975-1976 Excavations

Alaska Methodist University excavations directed by Workman investigated 54 localities scattered throughout the site. Thirty-three of these localities were either tested or excavated producing 559 artifacts including: 80 bone, antler, and horn, 259 cryptocrystalline lithic, 66 coarse lithic, 12 wood and bark, and 142 of native copper. Recent analysis found that three of the objects recovered from the site during the 1970s and originally cataloged as native copper are fragments of stone showing some green copper mineralization, which reduces the native copper artifact count to 139. An additional 1,041 lithic specimens consisting of small unretouched flakes and stones were also recovered. Six storage pits at the site were excavated and 15 were tested. Two large and several small camps were identified during excavations. Four pit localities within the site (24, 29, 47, and 50) represent campsites in association with cache pits. In all cases the habitation areas extend to the east of the pit with which they are contemporaneous based on both radiocarbon dating and stratigraphy. The two large camps, Pit 29 area and Feature 77-3-2/Pit 47, produced the majority of artifacts recovered from the site (Workman 1976). The

following features are discussed in more detail due to the presence of multiple native copper artifacts or their importance in reconstructing site chronology.

Pit 29 Area

Nearly half of the artifacts (268) recovered at the site came from the Pit 29 area consisting of the actual rectangular pit, measuring 6.05 m x 2.65 m, and the associated camp site to the east (Figure 5.6). The camp site is evidenced by the remains of postholes and multiple hearths, the largest of which measures 5 m x 1-2 m. The majority of cultural material was found in or near one of the hearth features. Fifty-six native copper artifacts were recovered from the Pit 29 area. Three radiocarbon dates were obtained for Pit 29 (Table 5.14). These include one at 195±130 radiocarbon years (Cal AD 1716-1891) obtained on charcoal from the upper part of a small hearth in the N6-8/E6-8 unit, and another date of 765±125 radiocarbon years (Cal AD 1153-1314) obtained using charcoal retrieved from a depth of 7 cm in a pit excavated into sterile soil. The charcoal was found in association with FCR, fish bone, and a barbed bone projectile point. The third date of 695±115 radiocarbon years (Cal AD 1222-1331) was obtained using decayed wood from 28 cm below the surface. The dated material was found just above basal gravels and is the remnants of the floor of a storage pit.

Feature 77-3-2/Pit 47

The excavation of this area produced the second largest collection of artifacts at the site after the Pit 29 area (over 120). As with the Pit 29 area, this feature had one large (3 m x 1-2 m) and several small hearths, and a pit measuring 5.4 m x 1.9 m. As noted by Workman (1976:23), the close association of both native copper tools and working scrap/debris with the hearth suggests that metal-working was a "significant activity" at this location. Forty-nine copper artifacts were recovered from Feature 77-3-2/Pit 47. Three radiocarbon dates were obtained from Feature 77-3-2 (associated with Pit 47). A date of 460±100 radiocarbon years (Cal AD 1394-1522) was obtained on charcoal found at a depth of 25 cm below the surface in a small pit. One of the other samples, obtained on charcoal from a depth of 50-55 cm below the surface in the bottom of a trench through Pit 47, returned a date that was pre-1950 but no more than 100 years. The third date was also

problematic. This sample counted in excess of the modern standard, which indicates exposure to ^{14}C from nuclear testing and is therefore modern.

77-3-5

This feature includes two separate concentrations of cultural remains, a cremation evidenced by human bone and a hearth. Nearly all of the artifacts, and all of the native copper, from this feature are associated with the hearth area of the excavation.

77-6-1

This feature represents an isolated hearth that had lithics and faunal remains and seven native copper artifacts.

Pit 50 Area

Pit 50 (4 m x 3.4 m) was completely excavated down to basal gravels. Wooden structural elements were uncovered during excavations. A date of 760±125 radiocarbon years (Cal AD 1154-1317) was obtained on charred wood from a wall timber from the N0-2/E2-4 unit. Hearths were present on the southern and eastern edges of the pit. Over 45 artifacts, four of native copper, were recovered from this area (Workman 1976).

77-3-3

This feature is a large hearth (4 m x 1 m) that had in association faunal remains and only seven artifacts, four of which were native copper.

77-5-1

This feature is a hearth located 2 m north of Pit 28. The hearth appears to have been excavated into the ground rather than resting on top. The hearth contained cemented ash, FCR, flaked and coarse stone lithics, faunal remains, and three artifacts of native copper (Workman 1976)

Pit 29/50

Cultural material, including three native copper artifacts, was recovered from a disturbed context between Pit 29 and Pit 50 during clearing of this portion of the site with heavy equipment (Workman 1976).

77-3-1

This feature is a hearth that was partially disturbed by mining activity and was later investigated by Workman (1976). It yielded faunal remains and eight artifacts, two of which were native copper.

77-4-LB3

This feature is an isolated hearth east of the Pit 29 area that had two artifacts of native copper in association.

77-3-4

Though only a single native copper artifact was recovered from this feature it will be discussed here because of its potential chronological importance. A rectangular piece of iron was recovered from this feature, approximately 11 cm below the surface and next to a hearth. The artifact is suspected to have been a knife blade. It was found in association with "a piece of copper wire" and "worked bone." Workman suggested that the copper wire may be an import, presumably because of its form, which is unique compared to the rest of the native copper inventory. However, NAA by Franklin *et al.* (1981a) and the current study confirmed that this specimen is made of native copper (see Chapter 6, Tables 6.2 and 6.5, artifact # GUL077/76-77). Due to the presence of the iron artifact, and perhaps suspicion over the origin of the copper wire, Workman (1976:116) suggests this feature indicates later, "early (?) contact period" activity at the site.

Pit 32

A date of 215±105 radiocarbon years (Cal AD 1721-1818) was obtained on charcoal from the outer portion of a large floor timber found in the bottom of this multi-celled cache (Workman 1976).

The 1986 Excavation

N76.58 E557.77

Three native copper artifacts were recovered during test excavations in 1986, two from the N76 E 557 unit and one from N75 E558. These units were part of Locality A near Workman's Pit 42, at the edge of the gravel pit as it existed in 1986. This locality was chosen for excavation due to the presence of cultural material in the cut bank of the gravel pit (Holmes and McMahan 1986).

The 1995-1996 Excavations

N89 E641.5

This is one of four units placed in the area of Workman's (1976) excavations. These four units were placed on the bluff edge of the gravel pit as it existed in 1995. The N86/E641 unit intersected the back fill of Workman's excavation of Feature 77-3-2. Eight native copper artifacts were recovered from the eastern half of this unit.

Metal Detector Survey

A metal detector survey of the northern portion of what remained of the site located six native copper artifacts in addition to historic debris related to a 20th century homestead. A possible lead musket ball was also found. A copper projectile point found during the metal detector survey was suspected to be an item of Euroamerican manufacture. Its symmetrical, triangular shape is unlike other native copper projectile points from the site or region and more similar to points from Great Bear Lake that are European trade items (Clark 1991:66, Plate 24).

N4908 E4948

This 2 m x 2 m unit contained a hearth feature and several artifacts including three of native copper. A date of 780±70 radiocarbon years (Cal AD 1147-1310) was obtained on a sample from the hearth.

N214 E723

This 2 m x 2 m unit was initially identified during the metal detector survey, which located a native copper projectile point. A copper nugget was also recovered from the south end of the unit.

Feature 95-36

This feature is a large (13.1 m x 7.3 m) rectangular house pit approximately 1m deep. It is the largest depression present at the site. It corresponds to Workman's Pit 21, which was tested in 1976 (Workman 1976). A 1 m x 8 m trench was excavated in the north end of the depression recovering only two possible flakes but wooden structural timbers (both upright and flat parallel) were identified in the

interior portion of the pit. A date of 720±60 radiocarbon years BP was obtained on wood from one of these timbers.

Site Summary

Though there is evidence of historic activity within the site, the majority of occupation and activity spans the period from AD 1150-1500 based on a recalibration of the radiocarbon dates originally provided by Workman (1976) and Hanson (1999). The lack of trade beads at the site is conspicuous and supports the interpretation that this site ceased to be intensively used after the Late Prehistoric Period. The single piece of iron may not necessarily be evidence of Historic (or even Protohistoric) occupation. However, one artifact deserves mention here. A coconut was found during shovel testing in the southern portion of the site in a marshy area below a thick peat layer. Though initially thought to be recent, coconut husk and shell has been found in abundance at the historic Russian site of Castle Hill in Sitka (McMahan 1999). The coconut is in all likelihood a Protohistoric or Historic artifact.

The Gulkana site has essentially no cultural stratigraphy. Most cultural material recovered from the site has been found just below the sod layer and when found at greater depths below the surface is always found in association with cache pits excavated into the ground surface. Both radiocarbon and stratigraphic dating of the site indicates that the pit features are contemporaneous with hearth/camping features (Hanson 1999; Holmes and McMahan 1986; Workman 1976).

A "late winter/early spring occupation" of the site was proposed based largely upon faunal remains with Pit 29 and Feature 77-3-2/Pit 47, providing the only evidence of intensive use. A large number of beaver and rabbit bones were recovered from the site. Beaver are noted ethnographically as having been hunted in the late winter/early spring and rabbits have been cited as "lean season fare" (Workman 1976:158-159). Numerous cache pits (over 50) attest to the importance of the site for food storage, probably salmon, berries, bone, and possibly dried meat, stored in summer to be consumed during the Winter/Spring. As Workman points out, the best time of year to actually dig the numerous cache pits at the site would

have been in the summer (late June to August). Despite the interpretation of the site as a late winter/early spring activity area, there is at least one depression that fits the ethnographic description of a winter house, Feature 95-36 (AD 1170-1290). This may indicate that at some point during the occupation of the site it served as a winter habitation and perhaps base for year-round activities.

GUL-077, TNX-004, VAL-065, and YAK-007 Comparisons

Typology

Workman (1976) developed a typology for the native copper artifacts that uses 12 major groups. Four of these groups have only a single member but the other eight groups were further subdivided into subgroups. The artifacts from 1986 and 1995-96 were initially placed within Workman's typology with the exception of two specimens that were placed in a newly created group called Copper Implement Fragment (Hanson 1999). Upon examining these two specimens I determined that they fit within the existing typology. See Table 5.13 for the major groups and number of specimens as originally developed by Workman for all four sites.

Though this typology is useful and makes clear that several stages of native copper artifact manufacture are present at the site, there are potential problems. Major groups with only a single member should perhaps be reassessed. The ring (CuRi), pendant (CuPe), and spiral (see Figure 5.7) are all small decorative items. The spiral was grouped into the Copper Implement Fragment category (Hanson 1999) as it was considered to be part of a larger artifact. This interpretation may be correct considering the use of spirals by Athapaskans in the manufacture of metal knives and spears; however, it may have been recovered as made. These three artifacts all appear to be decorative or ornamental. Furthermore, the single member of the Copper Rod (CuRo) group is not that far outside the range of other groups such as Unfinished Copper Implements (CuIU), or single (CuSP) or bipointed (CuBi) implements. Upon closer inspection, at least some of the Unmodified Copper Nuggets (CuNu) appear to have been somewhat flattened on a surface, though not heavily worked.

Copper Working Debris

Workman (1976:70) categorized 52 native copper artifacts as "by-products", meaning that they are pieces of worked native copper not readily identifiable as finished tools. The by-product category includes bar and rectangular shapes, thin sheet fragments (Figure 5.8), and thick worked specimens. These by-products were recovered from 10 of the 16 localities where native copper artifacts were found, reinforcing the notion that the manufacture of native copper tools was an important activity at the site. Additionally, native copper by-products and "unfinished implements" are often found in association with cemented ash from hearths perhaps providing evidence that heat treatment (annealing) was part of the technology of native copper working (Workman 1976). It should be pointed out that identifying an artifact as an "Unfinished Implement" without knowing what the intended artifact was supposed to be is problematic. Of the 170 copper artifacts recovered from GUL-077, 71 pieces are related to the manufacturing process. Only two would fall into a "non-utilitarian" category, a ring and a coil.

Two objects described as "debris" from VAL-065 are the two heaviest native copper artifacts in the region, 101 g and 139 g. The vast majority of native copper artifacts weigh less than 5g and few weigh more than 10g. They were manufactured by pounding together several small nuggets of native copper. The folds of numerous hammered sheets are visible on the surface and edges of these objects. They may be the axes or adzes, *tsedi biceni'aayi* and *tsedi tsentseli*, respectively, such as are referred to in the table of Ahtna terms in Chapter 4 (Table 4.2) (Kari 1990). This designation may be somewhat arbitrary but whatever they are it is unlikely that these substantial objects are leftover from the manufacture of something else and represent "debris."

Personal Adornment/Decorative

Cones

Fourteen cone-shaped objects of rolled sheet (Figure 5.9) were recovered from GUL-077 (Hanson 1999; Workman 1976). These have also been documented at other sites including TNX-004, VAL-065, and YAK-007. Several potential uses

of these objects have been suggested including: as toggling points for spearing fish (Hanson 1999:73), a stage in the manufacture of projectile points (Workman 1976:58; Franklin 1981a:21), or as beads or tinklers attached to clothes (de Laguna and McClellan 1981:658; Shinkwin 1979:26; Workman 1976:64). De Laguna (1934) thought the cones resembled dentalium shells, and that they were strung as beads on rawhide. Dentalium was an important source of wealth prior to and after contact as were beads starting in the Protohistoric period (Simeone 1995).

Spirals

Three spiral objects are reported from archaeological contexts, two from TNX-004 (Figures 5.10 [UA71-0035-0241] and 5.11 [0069(01) -0510]) (Shinkwin 1979) and one from GUL-077 (Figure 5.7) (Hanson 1999). Spiral forms in copper, most often associated with knife handles, have been mentioned by several scholars for south-central Alaska (*e.g.*, Birket-Smith and de Laguna 1938; McKennan 1959; Osgood 1937) and discussed in detail by Wayman *et al.* (1992) and Rogers (1965). A Tanana man, Patrick Saylor (Callaway and Miller-Friend 2001:107), explained that the native copper "curls" (spirals) on knives and spears represented caribou fences. These fences, constructed using small trees, were described by Saylor as consisting of "an opening with two corrals on both sides." Saylor also indicated that the spiral represented the "mother's side", *i.e.*, matrilineality, "because that meant the mother's womb." Such an explanation indicates that objects made of copper may have symbolic associations unrelated to the actual raw material.

Awls and Awl-like Artifacts

There are 37 awl-like specimens (bipoints, single points, and perforators) of varying size and shape from the Gulkana collection (see figure 5.12). One of the potential uses for the bipointed objects is that of a gorge for fishing (McClellan 1987; Workman 1976). Vernon (1990:511) found that awls were "…by far the most numerous utilitarian copper items found in excavated Old Copper sites…" and cites Miles (1951) as concluding that the awl was the most common copper object found cross-culturally in North America. The awl-like objects from Gulkana could have been used within the context of a variety of tool manufacturing tasks. An

examination of the Ahtna linguistic terms for copper objects introduced in Chapter 4 provides some potential terms by which such objects may have been known. *Tsedi tsel* and *tsedi tso'* refer to a copper awl and a copper pick or poker, literally "copper penis," respectively (Kari 1990).

Additionally, there are three terms related specifically to the manufacture of snowshoes: *tsedi ts'ighu* (copper snowshoe awl), *tsedi 'aas bes* (copper snowshoe-lacing needle), and *tsedi sesi* (copper snowshoe drill). Snowshoes would have been important for moving around the landscape at the time of year that GUL-077 was supposedly occupied (late winter/early spring). The manufacture of snowshoes may have been an important task carried out at the site. McClellan and Denniston (1981:382) have a figure (Figure 12) with several images detailing Athapaskan snowshoe technology. One image (i) shows a Southern Tutchone snowshoe tool kit containing four bone tools "used in working the lacing." Three of the four, two awls and a bipointed netting needle, closely resemble the form of native copper tools found at GUL-077 and elsewhere. The figure also depicts a Kaska awl, a triangular metal blade set into an antler handle, that was used to carve "V-shaped" holes in the frame through which lacing was run.

Interpretations

Discussing the inventory of organic artifacts at GUL-077, Workman suggests that the use of native copper may have superseded bone. Workman (1976:83) considers the absence of cryptocrystalline projectile points and bifacially retouched knives to be "conspicuous," and suggested that such items may have also been replaced by forms in native copper and "to a lesser degree, antler and bone." Though some replacement may have occurred the native copper artifacts at all three sites are found alongside lithic, and bone/antler technology.

The working of native copper was a significant activity that took place at the Gulkana site. The Pit 29 area and Feature 77-3-2/Pit 47 (see Table 5.12), with which N89 E641.5 and its eight native copper artifacts could be included, produced the bulk of artifacts including native copper. Though each of these features has an associated radiocarbon date, it is unclear as to how many episodes of native copper

working are represented at the site, *i.e.*, infrequent manufacture over a few centuries; intensive manufacture over a few days, or somewhere in between. A large amount of native copper working debris (105) was also found at VAL-065. As mentioned in Chapter 4, the area around the Chitina River is reportedly where copperworking specialists lived (Reckord 1983). A replicative study of native copper working would provide important information regarding the amount of time (hours) necessary to produce the native copper artifacts and working debris found at sites. However, this would not resolve the issue of periodicity of copper working.

Though VAL-065 has few objects of personal adornment, similar to GUL-077, the pattern of distribution of copper artifacts at the two sites is quite different. At GUL-077 copper artifacts are widely scattered throughout the extensive site often associated with hearth features, which could have been the loci of copper working, but without evidence of caching or hoarding. At VAL-065 copper artifacts are concentrated in, and associated with, the interior space of rectangular semi-subterranean house pits. The large difference in the amount of copper between the two houses excavated at the site, 85 versus 21, was considered by Shinkwin (1979) to be related to differential access to copper, and therefore power. The difference between these two Ahtna sites, separated in time by at least 300 and possibly as much as 900 years, suggests that copper became subject to greater control and by extension, became more highly valued. At present, the distribution of copper at GUL-077 does not provide unambiguous support for, or against, the notion of individual specialists or individual ownership. Though the distribution of copper is different than at VAL-065, the abundance of copper at this one site, though widely scattered, could be an indication of group (*i.e.*, family or lineage) specialization and, or, ownership and control.

Included in the inventory of copper artifacts from YAK-007 were four rings, six bracelets, three rolled sheet beads (or danglers), two coiled copper wire beads, and a bone bodkin with a piece of copper wire coiled around one end. This amounts to 16 objects of a decorative nature from the site. Compared to GUL-077 this represents a greater number of items of obvious personal adornment. A major difference between the copper artifact assemblages of GUL-077 and YAK-007 lies

in the fact that copper was undoubtedly being worked at the former whereas the material from YAK-007 points to consumption, with little manufacture. Beyond the producer/consumer dichotomy represented by the two sites, the YAK-007 assemblage indicates that copper was being used differently, that is, for the display of personal prestige or rank. De Laguna's informants in Yakutat Bay told her that the people there (descended from Ahtna, Eyak, and Tlingit groups) had formerly obtained copper in trade from the Ahtna and that it was only worn by the wealthy people of high status.

Similar to the general pattern of distribution of copper artifact types in the Great Lakes region as discussed by Leader (1988), sites in northwestern North America nearer copper sources are less likely to have decorative, non-utilitarian artifacts. There are few obvious examples of copper being used for items of personal adornment from Athapaskan sites in Alaska (TNX-004, GUL-077, VAL-065, and XMH-242) and the Yukon (JiVs-1, JiVs-2, JiVs-3, and MjVg-1) as compared to the site of YAK-007 on the coast. This difference is not strictly a function of distance as the site of YAK-007 is relatively nearer to the native copper deposits of south-central Alaska and southwestern Yukon than the site of MjVg-1. The use of copper by Athapaskan groups seems to be in large part an extension of pre-existing lithic technologies for utilitarian objects. Even though native copper was associated with high status among Native groups in northwestern North America, for those living near sources, it was also a ubiquitous material for making tools. Additional discussion and interpretation will be presented in Chapters 7 and 8.

Metallurgy and Chronology in Northwestern North America

An issue that has arisen while attempting to distinguish native copper from trade copper metals in the literature is the difficulty in determining whether a site should be considered Protohistoric or Historic (or both), or perhaps even occupied from the Late Prehistoric through the Protohistoric to the Historic Period. In North America the term Protohistoric is reserved for the interval during which Indigenous groups were receiving Euroamerican trade goods without having direct contact with Euroamericans. Workman (1977) has suggested the interval from 1770-1850 as the

Protohistoric period for the Ahtna region. One of the problems with using the Protohistoric concept is that during the same time that some regions are receiving Euroamerican trade goods indirectly, presumably from other Indigenous groups, other regions have already established direct contact with Euroamericans. Additionally, at the same time interval some Indigenous groups may not yet be receiving Euoramerican trade goods at all. Because the Protohistoric (and Historic) period varies geographically, all three periods may occur co-terminously. Furthermore, a single site within the Ahtna region exhibiting a typical Protohistoric assemblage (*i.e.*, trade beads, traditional bone and lithic tools, and metal) might span the Late Prehistoric, Protohistoric, and Historic Periods even if only occupied for a little more than 80 years. It would also appear that native copper and iron are both found at sites that lack trade beads including: YAK-007 (de Laguna *et al.* 1964), GUL-077 (Workman 1976), COR-001 (de Laguna 1956), and TNX-004 (Shinkwin 1979). This is not surprising given the availability of iron from Asia and Siberia to indigenous peoples in the western Arctic and Subarctic and Northwest Coast as early as the first few centuries AD as noted by several scholars (*e.g.* Acheson 2003; Keddie 1990; de Laguna 1956, 1972; McCartney 1988; Wayman *et al.* 1992).

A related problem is that of determining whether copper found at Native sites is native copper or industrial trade copper. This is complicated by the continued use of native copper by Indigenous peoples in northwestern North America up until the late 19th and early 20th century (Abercrombie 1900; Allen 1887; Legros 1984; Powell 1997; Schwatka 1996). The use of native copper did not end with the appearance of iron or industrial copper metals. Native copper was still being traded to the coast even when finished Euroamerican copper goods were being traded inland as late as the mid-1860s (Legros 1984). The presence of Euroamerican trade goods such as glass beads, ceramics, and iron, whether associated with a Protohistoric or Historic site, does not preclude the presence of native copper. Though Ketz (1983:154) mentions "uniform thickness" when classifying a piece of copper metal as being an import, native copper artifacts can be uniformly thin. Ketz's classification of the copper metal as a Euroamerican import

may be correct, but uniform thickness by itself is an insufficient criterion for making such a determination.

Fitzgerald and Ramsden (1988) conducted an experiment designed to help determine the type of copper metal found at Protohistoric and Historic Iroquoian sites in Ontario. Their experiment consisted of removing enough of the green patina on copper artifacts in order to observe the original colour of the metal. Their sample of 21 artifacts was sorted into two categories based on colour; reddish-orange, indicating copper metal with 99+% copper, and yellow, indicating brass. The samples were then analyzed using emission spectroscopy, verifying their classification based on colour. This study demonstrated the ability to distinguish copper-zinc alloys (brass) from copper metal using surface colour, without the need for materials analysis. Indeed, this could be done in the field. Presumably other copper alloys, such as bronze, made with tin, could also be distinguished from copper metal based on colour. However, the one definite native copper specimen (a nugget) used in the study was indistinguishable from the smelted trade copper.

After performing metallographic analysis of artifacts of both native copper and "recrystallized smelted copper of high purity," Maddin *et al.* (1980:223) determined that "no adequate criteria exist" for distinguishing between the two groups of material. Purity, hardness, presence of copper oxide particles, metal grain size and other metallographic features such as twinning, were all considered insufficient in determining whether a copper artifact had been fashioned from native or smelted copper. However, it should be noted that the smelted material analyzed was from an early context and was smelted at low temperatures from relatively pure copper ore minerals. Thus, this smelted copper would not be typical of later smelted copper due to its purity. Wayman *et al.* (1985) found that relatively finer grain size and the presence of non-metallic inclusions were sufficient for distinguishing nineteenth century smelted copper from native copper. This finding was confirmed by the results of NAA. It has been demonstrated that NAA can effectively distinguish between native and smelted copper. Native copper is generally cleaner (*i.e.*, more pure with fewer trace elements) and some trace elements are more characteristic of one or the other of the two types of metals (Hancock *et al.* 1991,

Wayman *et al.* 1985). Because NAA is not readily available and the colour method (Fitzgerald and Ramsden 1988) may not distinguish between native and high purity smelted copper, metallographic examination is an important means for distinguishing between native copper and 19th century smelted copper in northwestern North America (Wayman *et al.* 1985).

Several scholars have discussed the use and first appearance of metal (namely copper and iron) in northwestern North America (*e.g.*, Acheson 2003; Buchwald and Mosdal 1985; Franklin *et al.* 1981a; Jopling 1989; Keddie 1990; Keithahn 1964; McCartney 1988, 1991; Rickard 1939; Wayman 1989b; Wayman *et al.* 1992). In particular, the evidence for a metallurgical tradition(s) predating Euroamerican contact by many centuries have been reviewed by McCartney (1988) for the Arctic, Franklin *et al.* (1981a) for the Arctic and Subarctic, and Acheson (2003) for the Northwest Coast. The metals available for use include native copper, meteoric and telluric iron, drift iron from shipwrecks, and iron traded across the Bering Strait. A detailed inventory of archaeological sites in the Canadian Arctic and Subarctic and the Northwest Coast that have produced native copper and other metal artifacts is outside the scope of this thesis. The following brief overview of the evidence of metallurgy in the Arctic, Subarctic, and Northwest Coast regions is meant to provide a geographic and temporal context for the origin of native copper metallurgy in Alaska and the Yukon.

Canadian Arctic and Subarctic

The use of metal by Eskimo groups in arctic North America has long been recognized. The use of iron was noted for the Old Bering Sea culture, AD 200-500, found on both sides of the Bering Strait (Collins 1937; Chard 1960; Levin and Sergeyev 1964) and the Ipiutak culture, circa AD 350, of the Arctic coast of Alaska (Bandi 1969; Larsen and Rainey 1948; Rainey 1971). In the Canadian Arctic metal has been noted for many archaeological sites associated with Pre-Dorset, Dorset, and Late Dorset (AD 500-800) and Thule (AD 1000-Historic). The metals found at sites include copper (Taylor 1967), iron (Buchwald 1975; Schledermann 1975), or sometimes both (McGhee 1976, 1984; Rowley 1940).

McCartney used the term *epi-metallurgy* (1988; 1991) to refer to "dependency on, but not production of, metals" (1991:28). He noted that the Thule Eskimos did not smelt metals from ores or alloy or cast metals but were very much involved in working and using a variety of metals from various sources (native copper, telluric iron, and trade iron, copper, and copper alloys). According to McCartney (1988, 1991), metals were generally cold-hammered into tools and used until reduced to very small pieces.

Copper and iron were used by Late Dorset (ca. AD 800-1000) and Thule Eskimos groups (ca. AD 1000-1600). The metal potentially available for use by these groups would have included meteoritic and telluric (native) iron from Greenland and smelted iron and (Wayman 1989b) perhaps copper metal and its alloys from Norse settlements. Smelted iron and copper metal were also available from Siberia via trade across the Bering Strait and native copper was present in Coronation Gulf and the Coppermine River region (McCartney 1991). According to McCartney (1991:30), epi-metallurgy refers spatially to the early use of metals and experiments with metallurgy outside of "primary production areas." McCartney also defines epi-metallurgy sociopolitically noting that metal was "being manipulated through exchange systems of ranked or stratified societies, where metal is a status/prestige/wealth material" (1991:30).

Native copper was observed in the Timber Point Complex of the Canadian Tundra Tradition dating to 800 to 600 BC (Noble 1981). The Canadian Tundra Tradition represents a regional variant of the Arctic Small Tool Tradition, a Paleo-Eskimo culture. The majority of Canadian Tundra Tradition sites reported by Noble (1981), including Timber Point, are situated in the Northwest Territories and Nunavut east of Great Bear Lake, west of Hudson Bay, south of Coronation Gulf, and north of Great Slave Lake, except for two sites in northeast Manitoba. McGhee (1970) reports the presence of a single artifact of native copper in an Arctic Small Tool site, Bloody Falls on the Coppermine River, dated to 3300 BP or around 1300 to 1200 BC.

Native copper artifacts have been associated with the Taltheilei Shale Tradition by Noble (1981) and Gordon (1977, 1996) though the total number

reported is quite low (less than 20) and may include historic trade metal. Noble dated the Taltheilei Shale Tradition to 500 BC to AD 1840, and Gordon (1996) dated the Late Phase of the tradition to AD 550 to 1750. This tradition is considered to be ancestral Athapaskan and its geographic extent generally overlaps with the earlier Paleo-eskimo Canadian Tundra Tradition. A single "small native copper awl or punch" (Noble 1981:104) is reported for the Windy Point Complex, AD 200-400. Native copper is not mentioned again by Noble until a discussion of the Frank Channel Complex, AD 1300-1500. The region inhabited by the Canadian Tundra Tradition and Taltheilei Tradition has multiple distinct locales where native copper can be collected (Hearne 1958; Kindle 1970, 1972; sources listed by Franklin *et al.* 1981a). At the time of contact parts of this region were inhabited both by the Yellowknife, an Athapaskan-speaking group, and the Copper Eskimo, their territories overlapping at the Coppermine and upper Burnside Rivers.

Most discussions of metal in the Arctic deal with native copper or iron (meteoritic, telluric, or smelted), though see Wayman *et al.* (1985) for analysis of Historic period copper metal. Two copper artifacts from the Thule components of archaeological sites in Resolute Bay on Cornwallis Island in the High Arctic were subjected to neutron activation analysis. Both specimens were determined to be made of non-native copper indicating that in addition to smelted iron, industrial copper alloys were available prior to contact via trade with either the Norse or across the Bering Strait (Franklin *et al.* 1981a).

Northwest Coast

As with the discussion of metallurgy in the Arctic and Subarctic, an inventory of sites with metal on the Northwest Coast is outside of the scope of this thesis. Native copper artifacts from archaeological contexts on the Northwest Coast are rare and only found in a significant quantity at the Boardwalk Site (GbTo31) in Prince Rupert Harbour where they occur in burials (Ames 2005; MacDonald 1983). Ames (2005) lists 13 artifacts including: eight copper tubes, two bracelets, two sheet fragments, and a copper bead. MacDonald (1983) indicates there are 20 copper artifacts and mentions a pair of earrings from the site but no such items are included

in Ames' discussion. Perhaps MacDonald counted the wooden dowels (N=10) that some of the copper tubes were found wrapped around. Couture (1975) analyzed all of the copper artifacts from the Boardwalk Site. He actually lists 14 objects. The bead, two bracelets, and eight copper tubes can all be cross-referenced with Ames (2005). Specimens 580 and 581 are assumed to be the two pieces of copper sheet though Ames does not include their catalog numbers in his description. Couture also lists #80, which Ames lists as a wooden dowel.

When Borden (1970) recovered copper ornaments from Prince Rupert Harbour he attributed them to the Marpole Phase (400 BC to 400 AD). MacDonald (1983) states that the copper artifacts date to around 500 BC but it is unclear from where this date is derived. Burial 338, which contained both of the copper bracelets is reported by Matson and Coupland (1995:234) as "thought to date to about 2500 BP," but the source of the date is not provided. Ames (2005) provided two radiocarbon dates relevant to a discussion of the copper artifacts, including a date of 1865±50 BP (Cal 190 BC-AD 60) on human bone from burial 322. Unfortunately, this burial had no copper artifacts, but it did have a wooden dowel. Thus, the date does not directly refer to copper. Ames (2005) noted that copper tubes and wooden dowels are not always found in association. This leaves open the question as to whether an association with native copper technology can be inferred for this burial. The second date is from burial 325 that had a single fragment of native copper. Ames (2005) reported a date of 2565±60 BP (Cal 1020 BC-800 BC) on human bone from this burial. Details of the radiocarbon dates are provided by Ames (2005:49-51). A native copper artifact from a Haida site on the southern part of Moresby Island was recovered from a context radiocarbon dated to AD 1150-1400 (Acheson 2003).

Alaska and the Yukon

According to the above dates associated with the Boardwalk Site, the use of native copper on the southern Northwest predates its appearance on the northern Northwest Coast in Yakutat Bay, Alaska (YAK-007) by more than 2000 years (de Laguna *et al.* 1964:202-206). Furthermore, it pre-dates the use of native copper in

the source area of south-central Alaska and southwestern Yukon by almost 2000 years, or more (Hanson 1999; Workman 1976, 1977, 1978). It should be noted that this is based on a small number of analyses over a wide geographic region. The difference in the timing of the appearance of copper in the northern and southern portions of the Northwest Coast was noted by de Laguna *et al.* (1964:204) who stated, "…there is no necessary connection between the copper work in these areas." Workman (1978) considered early examples of copper artifacts reported from both the Arctic and Northwest Coast to be unrelated to the Late Prehistoric use of copper in south-central Alaska and the Yukon.

Though the copper-rich region of south-central Alaska and southwestern Yukon has been suggested as the source for copper found in archaeological contexts on the Northwest Coast (Acheson 2003; Ames and Maschner 1999; Blake 2004; Burley 1981), native copper is present further south on the Northwest Coast in British Columbia (*e.g.*, Chapman 1979 in Burley 1981; Sanger 1970; Mayne 1861 and Boas 1890 in Wilson and Carlson 1980; sources cited in Acheson 2003 and Hayden and Schulting 1997) Washington (Hayden and Schulting 1997) and the interior portion of B.C. (Drucker 1943). In addition to artifacts of native copper, iron, whether ultimately derived from shipwrecks or trade across the Bering Strait, has also been recovered from late prehistoric and protohistoric contexts in Alaska (de Laguna *et al.* 1964; Shinkwin 1979; Workman 1976) and the Northwest Coast (Keddie 1990). According to Reckord (1983:52) the "Eyak [occupants of part of the Gulf of Alaska] collected drift iron on Montague Island and traded it to interior groups."

Summary

The majority of archaeological finds of native copper fall within the vast geologically cuprifeous zone in southwestern Yukon and south-central Alaska. Native copper was used by Athapaskan, Tlingit, Eyak, and Chugach Eskimo groups in this region both at the time of contact and prehistorically, beginning about AD 1000. In addition to the sites inventoried in this chapter there are reportedly several native copper artifacts from southwestern Yukon and south-central and interior

Alaska that have been found by private landowners and miners. The context of native copper artifacts is restricted to the late prehistoric period though the site of MjVg-1 in the northern Yukon, part of which pre-dates the Late Prehistoric period, may be the earliest occurrence of native copper in this region.

Native copper sources are widely scattered throughout the region but the main concentration of sources are to be found in what is today Wrangell-St. Elias National Park and Preserve (WRST-NP/P). Most of these sources fell within traditional Ahtna territory, specifically that of the Lower Ahtna. Native copper circulated within this region and beyond. Though the sources may have been difficult to control, there were attempts to control the movement of native copper through trade and exchange by groups and individuals. Native copper often, but not always, moved through kin networks. Native copper also circulated via silent trade, raiding, trade fairs, and in the contact period, trips to Euroamerican facilities. A discussion of the origins and chronology of native copper metallurgy will be reserved for later. The following chapter describes the metallographic examination of eight native copper artifacts from GUL-077 and reports the results of an attempt to source native copper in the region.

Table 5.1 Time Periods.

Period	Age
Prehistoric	Prior to 1000 AD
Late Prehistoric	AD 1000-1700
Protohistoric	AD 200-1850
Historic	AD 1741-1850

Table 5.2 Archaeological sites in southwestern Yukon Territory with native copper.

ID #	Site #	# Cu	Cultural Affiliation	Period/Associated Date
A1	JaUk-23	1	Athapaskan/Tagish	LPre - Post-AD 750
A2	JaUn-4	1	Athapaskan/Tagish	LPre/Pro/H - Post-AD 750
A3	JbUf-2	2	Inland Tlingit	LPre/P/H
A4	JbUn-1	1	Athapaskan/Tagish	Pre/Pro/H
A5	JcUj-12	1	Inland Tlingit	LPre/Pro/H
A6	JcUw-3	1	Athapaskan/Tutchone	Pre
A7	JdVe-3	1	Athapaskan/Tutchone	Pre/LPre
A8	JeUs-3	?	Athapaskan/Tutchone/Tagish	Pre
A9	JeVb-15	1	Athapaskan/Tutchone	Pre/Pro/H
A10	JfUv-7	?	Athapaskan/Tutchone	LPre/Pro/H
A11	JfVg-6	1	Athapaskan/Tutchone	LPre
A12	JgVu-4	1	Athapaskan/Tutchone	LPre - Post-AD 750
A13	JhVf-4	2	Athapaskan/Tutchone	LPre - Post-AD 750
A14	JiVs-1	4	Athapaskan/Tutchone	LPre - Post-AD 750
A15	JjVi-1	1	Athapaskan/Tutchone	Pre/Pro/H
A16	JjVi-7	15	Athapaskan/Tutchone	LPre - Post-AD 750
A17	JjVj-28	1	Athapaskan/Tutchone	Pre
A18	KbTx-06	?	Athapaskan/Tutchone	LPre/Pro/H - Post-AD 750
A19	KbTx-20	1	Athapaskan/Tutchone	Pre/LPre
A20	KbVo-1	8	Athapaskan/Tutchone	LPre/Pro/H - Post-AD 750
A21	KdVa-8	5	Athapaskan/Tutchone	LPre - Post-AD 750
A22	KdVo-3	2	Athapaskan/Tutchone	LPre - cal AD 1155-1281
A23	KeVe-2	7	Athapaskan/Tutchone	LPre/Pro/H - Post-AD 750/ ca. AD 1600-1700/1770-1930
A24	LaVk-10	?	Athapaskan/Gwich'in	LPre/Pro/H

Table 5.3 Archaeological sites in south-central Alaska with archaeological copper.

ID #	Site #	# Cu	Cultural Affiliation	Period - Associated Date
A25	TNX-004	44	Athapaskan/Tanana	LPre/Pro/H - ca. AD 1200-1500
A26	TNX-?	1	Athapaskan/Tanana	Pre
A27	XMH-205	2	Athapaskan/Tanana	Pre
A28	XMH-242	1	Athapaskan/Ahtna	Pre
A29	HEA-062	1	Athapaskan/Tanana	LPre - ca. AD 1400-1500
A30	HEA-189	2	Athapaskan/Ahtna	Pre/Pro/H - ca. AD 1700 -1800
A31	GUL-033	1	Athapaskan/Ahtna	Pre/Pro/H
A32	GUL-038	1	Athapaskan/Ahtna	Pre/Pro/H
A33	GUL-076	1	Athapaskan/Ahtna	LPre
A34	GUL-077	170	Athapaskan/Ahtna	LPre/Pro - ca. AD 1100-1500
A35	GUL-079	3	Athapaskan/Ahtna	Pro/H
A36	TLM-222	1	Athapaskan/Ahtna	Pro
A37	XMC-098	1	Athapaskan/Ahtna	Pre
A38	XMC-398	1	Athapaskan/Ahtna	Pre
A39	VAL-065	138	Athapaskan/Ahtna	LPre/Pro/H - ca. AD 1816-1836
A40	VAL-186	1	Athapaskan/Ahtna	Pro
A41	VAL-187	1	Athapaskan/Ahtna	Pre
A42	YAK-007	48	Tlingit/Yakutat	LPre/Pro/H - ca. AD 1500-1791
A43	YAK-009	1	Tlingit/Yakutat	LPre/Pro

Table 5.4 Archaeological sites in Prince William Sound with native copper.

ID #	Site #	# Cu	Cultural Affiliation	Period - Associated Date
A44	ANC-0117	?	Eskimo/Chugach	Pre
A45	COR-001	5	Eskimo/Chugach	Pre/LPre - ca. AD 1420-1500
A46	SEW-056	1	Eskimo/Chugach	LPre/Pro/H - ca. AD 1470-1660
A47	SEW-072	2	Eskimo/Chugach	Pre
A48	SEW-077	1	Eskimo/Chugach	LPre/Pro/H
A49	SEW-078	1	Eskimo/Chugach	Pre
A50	SEW-081	1	Eskimo/Chugach	Pre
A51	SEW-488	2	Eskimo/Chugach	LPre - ca. AD 1300-1500

Table 5.5 Archaeological sites in Cook Inlet and western Kenai Peninsula with native copper.

ID #	Site #	# Cu	Cultural Affiliation	Period - Associated Date
A52	ANC-036	2	Athapaskan/Dena'ina	LPre/Pro
A53	ANC-038	1	Athapaskan/Dena'ina	LPre
A54	ANC-037	1	Athapaskan/Dena'ina	LPre
A55	ANC-054	1	Eskimo/Chugach	LPre - ca. AD 1150-1400
A56	ANC-268	1	Athapaskan/Dena'ina	Pre
A57	KEN-007	2	Athapaskan/Dena'ina	Pre/Pro/H
A58	KEN-020	?	Athapaskan/Dena'ina	Pre/Pro/H
A59	KEN-028	?	Athapaskan/Dena'ina	Pre/Pro/H
A60	KEN-066	3	Athapaskan/Dena'ina	LPre/Pro/H - ca. AD 1100-1200
A61	SEW-214	4	Athapaskan/Dena'ina	Pre/Pro/H
A62	KEN-094	2	Athapaskan/Dena'ina	LPre/Pro
A63	SEL-079	1	Post-Kachemak/Eskimo /Athapaskan/Dena'ina	Pre/LPre - ca. AD 850-1500
A64	SEL-001	5	Post-Kachemak/ Athapaskan/Dena'ina	Pre/LPre - Post ca. AD 570-770
A65	SEL-041	2	Post-Kachemak/Eskimo	Pre - AD 600-1000

Table 5.6 Archaeological sites in southeastern Alaska with native copper.

ID #	Site #	Cultural Affiliation	# Cu	Period - Associated Date
A66	SIT-135	Tlingit/Hutsnuwu	1	Pre - ca. 1300
A67	SIT-244	Tlingit/Hutsnuwu	1	Pre/Pro/H - ca. AD 1000-1600

Table 5.7 Archaeological sites in southwestern Alaska with native copper.

ID #	Site #	# Cu	Cultural Affiliation	Period - Associated Date
A68	ILI-001	1?	Athapaskan/Dena'ina	H
A69	XMK-016	3(1?)	Eskimo	Pre/H - AD 1450-1800/post AD 1800
A70	XMK-034	3	Eskimo	Pre - AD 1450-1800
A71	NAK-015	3	Eskimo	Pre/H - AD 1450-1800
A72	KAR-023	1	Eskimo/Koniag	Pre
A73	KAR-121	1	Eskimo/Koniag	Pre
A74	KOD-101	1	Eskimo/Koniag	Pre

Table 5.8 Archaeological sites in northern Yukon Territory and northern interior Alaska with native copper.

ID #	Site #	# Cu	Cultural Affiliation	Period/ Associated Date
A75	HAR-001	1	Eskimo/Inupiat	LPre - ca. AD 1400
A76	XBM-009	2	Eskimo/Inupiat	LPre - ca. AD 1400
A77	AMR-058	4	Eskimo/Inupiat	Pro/H - ca. AD 1840-1850
A78	XHP-308	7	Eskimo/Inupiat	LPre/Pro/H - ca. AD 1400-1660
A79	Galbraith	1	Athapaskan/Gwich'in	?
A80	Chandler	?	Athapaskan/Gwich'in	LPre
A81	PSM-074	1	Athapaskan/Gwich'in	LPre/Pro - ca. AD 1440-1700
A82	MhVf-1	1	Athapaskan/Gwich'in	LPre/Pro/H
A83	MjVg-1	14	Athapaskan/Gwich'in	LPre/Pro/H - ca. 100 BC-AD 600/AD 700-1640
A84	MjVk-7	1	Athapaskan/Gwich'in	LPre
A85	MjVl-1	3	Athapaskan/Gwich'in	LPre/Pro/H
A86	MjVl-6	?	Athapaskan/Gwich'in	LPre
A87	MLZ-050	1	Athapaskan/Koyukon	Pre - ca. AD 500-1000
A88	MMK-004	2	Athapaskan/Koyukon	LPre/Pro/H - ca. AD 1750-1950
A89	NUL-010	3-4	Athapaskan/Koyukon	Pre/Pro/H

Table 5.9 Distribution of native copper artifacts.

# of Sites	45	29	2	2	2	9
# of Cu artifacts	1	2-8	14-15	44-48	138-174	?

Table 5.10 Four largest collections of native copper artifacts in the region.

Site #	GUL-077	VAL-065	TNX-004	YAK-007
# Cu	170	138	44	48
Age	AD 1150-1500	AD 1816-1838	AD 1225-1520	AD 1485-1791

Table 5.11 GUL-077 Features/Units with native copper, 1970s, 1986 and 1990s.

Feature/Unit	Pit 29	77-3-2	77-3-5	N89 E641.5	77-6-1	MDS	Pit 50
# Cu	56	49	10	8	7	6	4
Feature/Unit	77-3-3	77-5-1	N4908 E4948	Pit 29/50	77-3-1	N76.58 E557.77	77-4-LB3
# Cu	4	3	3	3	2	2	2

Table 5.12 Native copper artifacts at GUL-077 Pit 29 area and Feature 77-3-2/Pit47.

Pit 29 Area		Feature 77-3-2/Pit 47	
Quantity	Form	Quantity	Form
10	bipoint	4	bipoint
9	sheet	8	sheet
6	projectile point	6	cone
6	cone	4	knife
5	knife	6	tool w/transverse edge
4	tool w/transverse edge	2	nugget
3	nugget	5	flat worked
2	flat worked	1	miscellaneous implement
2	miscellaneous implement	7	rolled bars
2	rolled bar	1	single point
2	single point	2	rectangle
1	rectangle	2	blanks
1	rod	1	curved cut
1	pendant		
1	ring		
1	bipoint/cone composite		

Table 5.13 Native copper artifact typology for GUL-077, TNX-004, VAL-065, and YAK-007.

Description	Workman's 1976 Code	GUL-077	TNX-004	VAL-065	YAK-007
Bipoints	CuBi	25			
Pieces with single points	CuSP	9			
Wire Hafted Perforators	CuWP	2			
Needles				5	
Subtotal Single and Bipoints/Perforators/Awls		**36**	**14**	**12**	**9**
Stemmed Backed Knives	CuKS	9			
Small Backed Knives	CuKBS	3			
Large Backed Knife	CuKBL	1			
Subtotal Knives		**13**		**5**	**10**
Rolled Sheet Cone - Bead/Dangler	CuCo	16	1	2	3
Ring	CuRi	1			4
Bracelet					6
Sheet Pendant	CuPe	1			
Spiral		1	2		
Coiled wire bead					2
Subtotal Decorative/Personal adornment		**3/19**	**3**	**2**	**13/16**
Unfinished Implements	CuIU	10			
By-Products	CuBP	64			
Unmodified Nuggets	CuNu	9			
Subtotal Copper working Debris/Scrap		**71**	**18**	**106**	**5**
Projectile Points	CuPo	8	8	6	5
Blanks				7	
Implements with Transverse Working Edges	CuITE	12			
Rod	CuRo	1			
Hook					2
Composite			1		1
Total		**174**	**44**	**138**	**48**

Table 5.14 Radiocarbon dates.

Site #	Lab #	Material	Radiocarbon Years BP	Reported Calendar Date/Date Range	CALIB 5.0 1σ	Prob.	Reference
MLZ-050	S-976	calcined bone	1325±260	cal AD 365-885 - 1σ	AD 528-987	90%	Clark and Clark 1993
PSM-074	ASPC-19	charcoal	310±140	uncal AD 1640	AD 1441-1680	86%	Wilson 1978
XHP-308		sinew	470±40	cal AD 1410-1470 - 2σ	AD 1417-1449	100%	Kunz *et al.* 2005
XHP-308		sinew	290±40	cal AD 1490-1660 - 2σ	AD 1472-1667	94%	Kunz *et al.* 2005
MjVg-1	NYRP 77-3	charcoal	340±90	cal AD 1405-1795 - 2σ	AD 1471-1640	100%	Le Blanc 1984
MjVg-1	NYRP 77-2	charcoal	370±80	cal AD 1395-1660 - 2σ	AD 1450-1525	51%	Le Blanc 1984
MjVg-1	NYRP 77-1	charcoal	500±90	cal AD 1310-1515 - 2σ	AD 1385-1479	68%	Le Blanc 1984
MjVg-1	74-3	bone	550±80	cal AD 1265-1490 - 2σ	AD 1308-1361	50%	Le Blanc 1984
MjVg-1	NYRP 78-6	bone	940±70	cal AD 920-1230 - 2σ	AD 1025-1159	100%	Le Blanc 1984
MjVg-1	NYRP 78-2	charcoal	950±90	cal AD 890-1250 - 2σ	AD 1015-1185	100%	Le Blanc 1984
MjVg-1	NYRP 78-4	charcoal	1150±60	cal AD 665-1015 - 2σ	AD 912-970	39%	Le Blanc 1984
MjVg-1	NYRP 78-1	charcoal	1180±80	cal AD 620-1030 - 2σ	AD 771-901	72%	Le Blanc 1984
MjVg-1	NYRP 78-7	charcoal	1510±80	cal AD 255-635 - 2σ	AD 529-622	64%	Le Blanc 1984
MjVg-1	NYRP 78-3	charcoal	2010±70	cal 175 BC - AD 200 - 2σ	99 BC - 70 AD	100%	Le Blanc 1984
SEL-001	P-138		1369±102	uncal AD 581	AD 576-772	100%	Workman *et al.* 1980
SEL-041	UGa-2340		1130±120	uncal AD 820	AD 773 - 1019	100%	Workman *et al.* 1980
SEL-041	UGa-2341		1315±205	uncal AD 625	AD 547 - 902	90%	Workman *et al.* 1980
SEL-041	UGa-2339		1090±195	uncal AD 860	AD 769 - 1053	78%	Workman *et al.* 1980
SEL-079	UGa-3638		410±55	uncal AD 1540	AD 1434 - 1518	80%	Workman and Workman 1988
SEL-079	UGa-3634		1030±205	uncal AD 920	AD 852 - 1189	87%	Workman and Workman 1988
SEL-079	UGa-3637		680±55	uncal AD 1270	AD 1272 - 1314	58%	Workman and Workman 1988

Table 5.14 Radiocarbon dates, continued

Site #	Lab #	Material	Radiocarbon Years BP	Reported Calendar Date/Date Range	CALIB 5.0 1σ	Prob.	Reference
KEN-066	WSU-3107		895±85	cal AD 1157	AD 1117-1213	59%	Reger 1998; Reger and Boraas 1996
KEN-094	WSU-3087	charcoal	335±55	cal AD 1420-1950 - 2σ	AD 1558-1631	54%	Holmes 1988
KEN-094	WSU-3088	charcoal	90±95	cal AD 1420-1950 - 2σ	AD 1805-1933	70%	Holmes 1988
SEW-214	WSU-3089	charcoal	565±65	cal AD 1310-1420 - 1σ	AD 1309-1361	58%	Holmes 1988
ANC-054	GX-4409		790±120	cal AD 1257	AD 1150-1298	78%	Reger 1998; Reger and Boraas 1996
ANC-054	WSU-1887		650±70	cal AD 1296	AD 1345-1393	53%	Reger 1998; Reger and Boraas 1996
COR-001	Beta-98048		430±40	cal AD 1450	AD 1429-1485	99%	Yarborough 2000
COR-001	Beta-98051		400±60	cal AD 1470	AD 1438-1521	73%	Yarborough 2000
SEW-056	WSU-3913	charcoal	295±90		AD 1473-1665	96%	Yarborough and Yarborough 1989
SEW-488	Beta-89040	charcoal	360±60	cal AD 1435-1660 - 2σ	AD 1459-1524	50%	Yarborough 1997
SEW-488	Beta-89046	charcoal	520±50	cal AD 1315-1345/1390-1455 - 2σ	AD 1395-1441	84%	Yarborough 1997
SEW-488	Beta-89047	charcoal	560±70	cal AD 1290-1455 - 2σ	AD 1309-1361	54%	Yarborough 1997

Table 5.14 Radiocarbon dates, continued.

Site #	Lab #	Material	Radiocarbon Years BP	Reported Calendar Date/Date Range	CALIB 5.0 1σ	Prob.	Reference
NAK-015	Beta-34424		240±80		AD 1732-1808	32%	O'Leary 1999
NAK-015	Beta-67125		260±80		AD 1493-1602	45%	O'Leary 1999
NAK-015	Beta-71500		430±70		AD 1417-1519	83%	O'Leary 1999
NAK-015	Beta-71501		340±70		AD 1539-1634	66%	O'Leary 1999
YAK-007	P-178	charcoal	136±62	uncal AD 1760-1884	AD 1832-1886	28%	de Laguna *et al.* 1964
YAK-007	?	charcoal	328±78	uncal AD 1552-1698(1708)/1677-1833	AD 1485-1642	100%	de Laguna *et al.* 1964
SIT-135	Beta-13513	shell	668±86		AD 1270-1328	51%	Moss *et al.* 1989
SIT-244	Beta-31240	shell	278±86		AD 1487-1604	58%	Moss *et al.* 1989
SIT-244	PIT-04	shell	468±67		AD 1397-1491	92%	Moss *et al.* 1989
SIT-244	Beta-22074	shell	905±103		AD 962-1284	98%	Moss *et al.* 1989
GUL-077	GX-4297	charcoal/charred wood	195±130	uncal AD 1755	AD 1716 - 1891	59%	Workman 1976
GUL-077	GX-4298	charcoal	765±125	uncal AD 1185	AD 1153 - 1314	80%	Workman 1976
GUL-077	GX-4299	charred wood	760±125	uncal AD 1190	AD 1154 - 1317	80%	Workman 1976
GUL-077	GX-4300	wood	695±115	uncal AD 1255	AD 1222 - 1331	64%	Workman 1976
GUL-077	GX-4389	charcoal	215±105	uncal AD 1735	AD 1721 - 1818	36%	Workman 1976
GUL-077	GX-4391	charcoal	460±100	uncal AD 1490	AD 1394 - 1522	74%	Workman 1976
GUL-077	4922	wood	720±60		AD 1237 - 1301	79%	Hanson 1999
GUL-077	4923	hearth	780±70		AD 1147 - 1310	87%	Hanson 1999
HEA-062	I-9882	charcoal	460±115	uncal AD 1375-1605 - 1σ	AD 1393 - 1523	67%	Plaskett 1977
HEA-189	DIC 3069	charcoal	180±60	uncal AD 1710-1830 - 1σ	AD 1727 - 1813	52%	Betts 1987
TNX-004	P-1832	charcoal	770±40	uncal AD 1180±40	AD 1225-1275	100%	Shinkwin 1979
TNX-004	P-1833	charcoal	390±50	uncal AD 1560±50	AD 1443-1521	74%	Shinkwin 1979
KdVo-3	Beta-68512	charred organic	810±80		AD 1155-1281	98%	Yukon Heritage Branch Site Files 2005

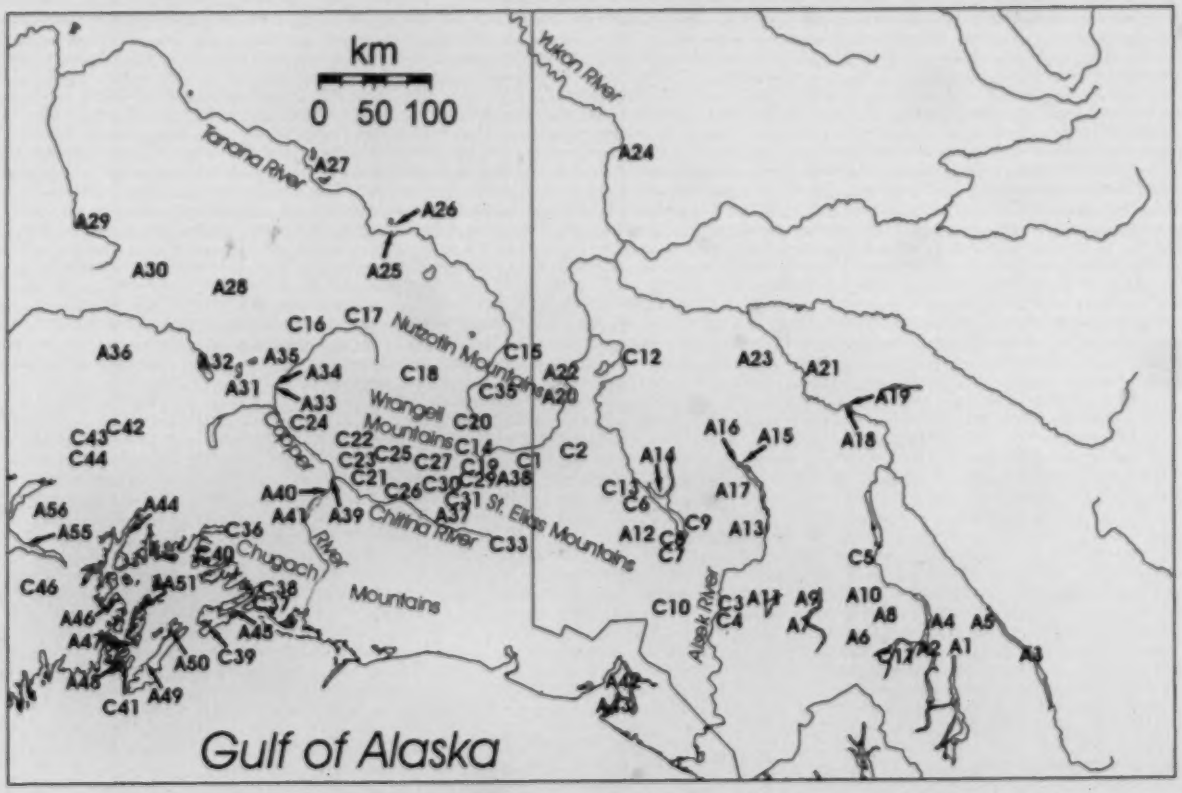

Figure 5.1 Potential native copper sources and archaeological sites with native copper artifacts in south-central Alaska and southwestern Yukon Territory.

A = archaeological sites, C = potential sources of native copper.

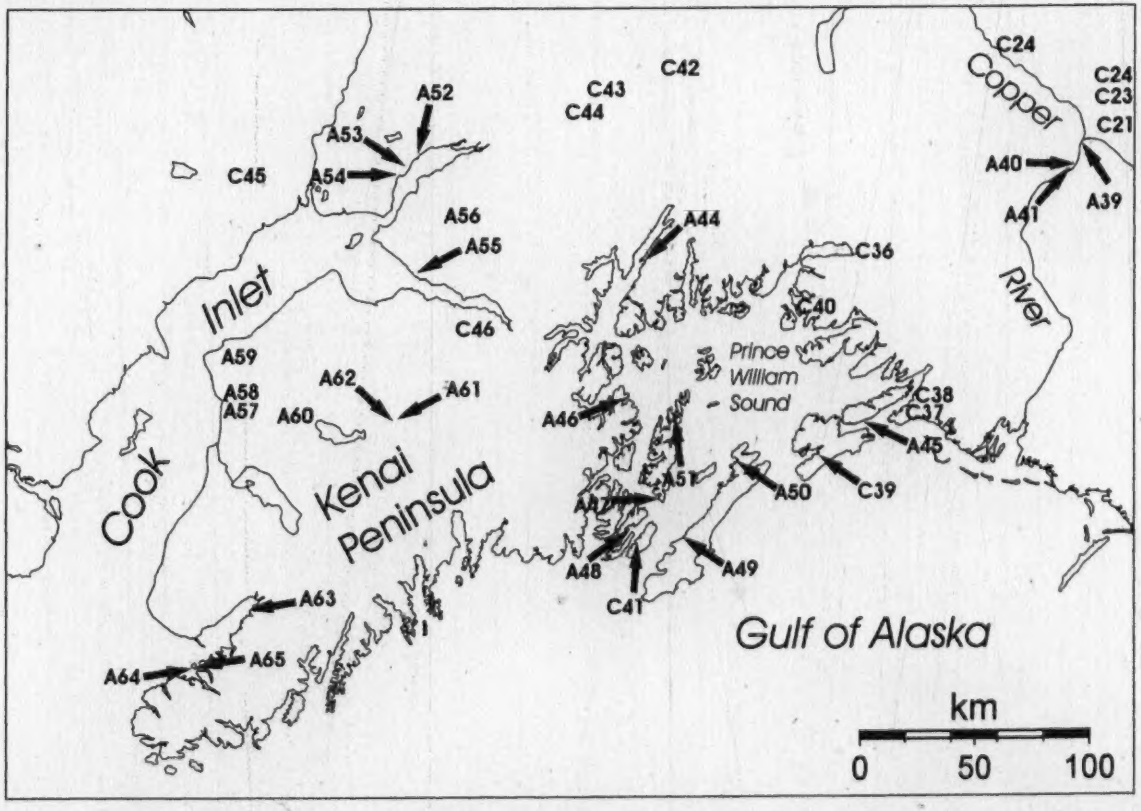

Figure 5.2 Potential native copper sources and archaeological sites with native copper artifacts in Prince William Sound, Kenai Peninsula and Cook Inlet.

A = archaeological sites, C = potential sources of native copper.

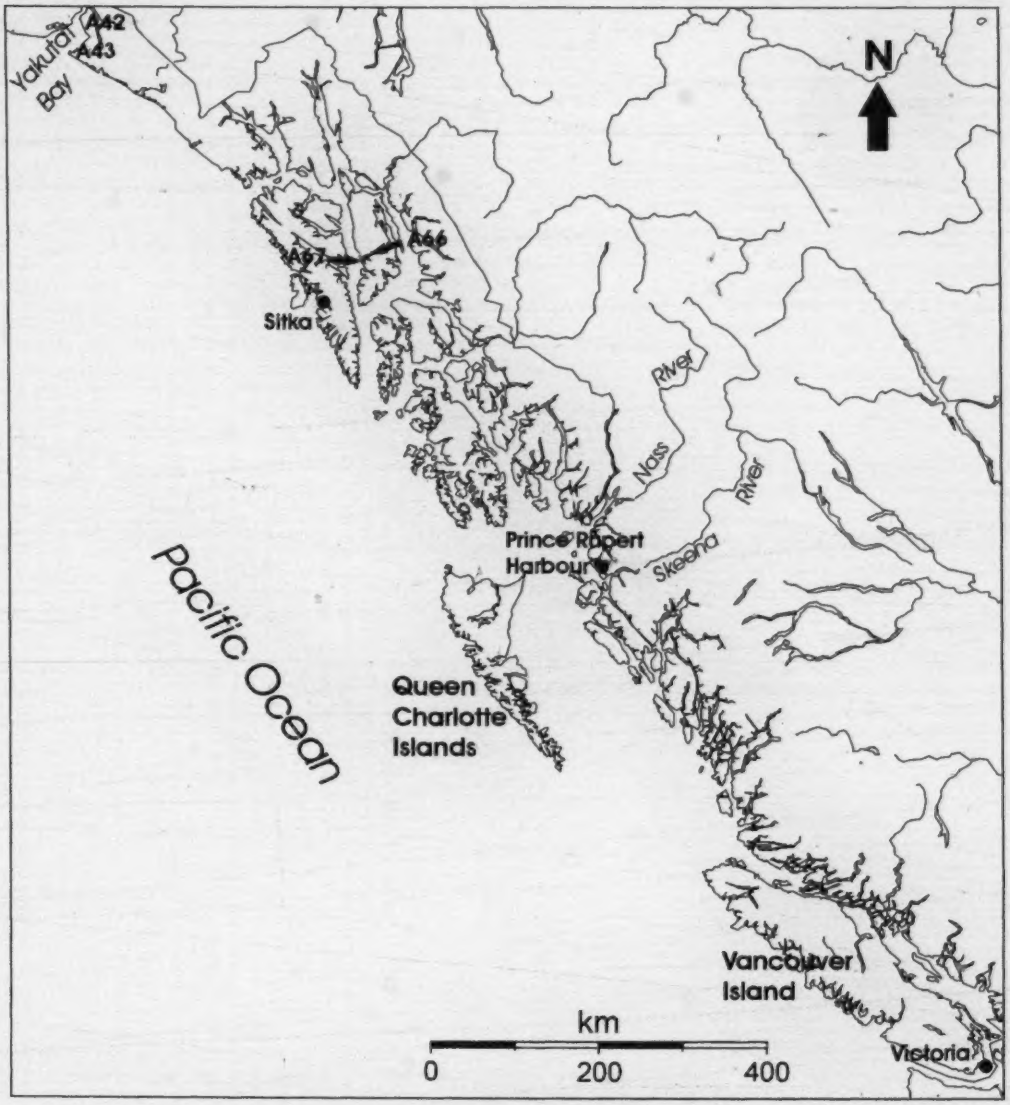

Figure 5.3 Archaeological sites with native copper artifacts in southeastern Alaska.

A = archaeological sites, C = potential sources of native copper.

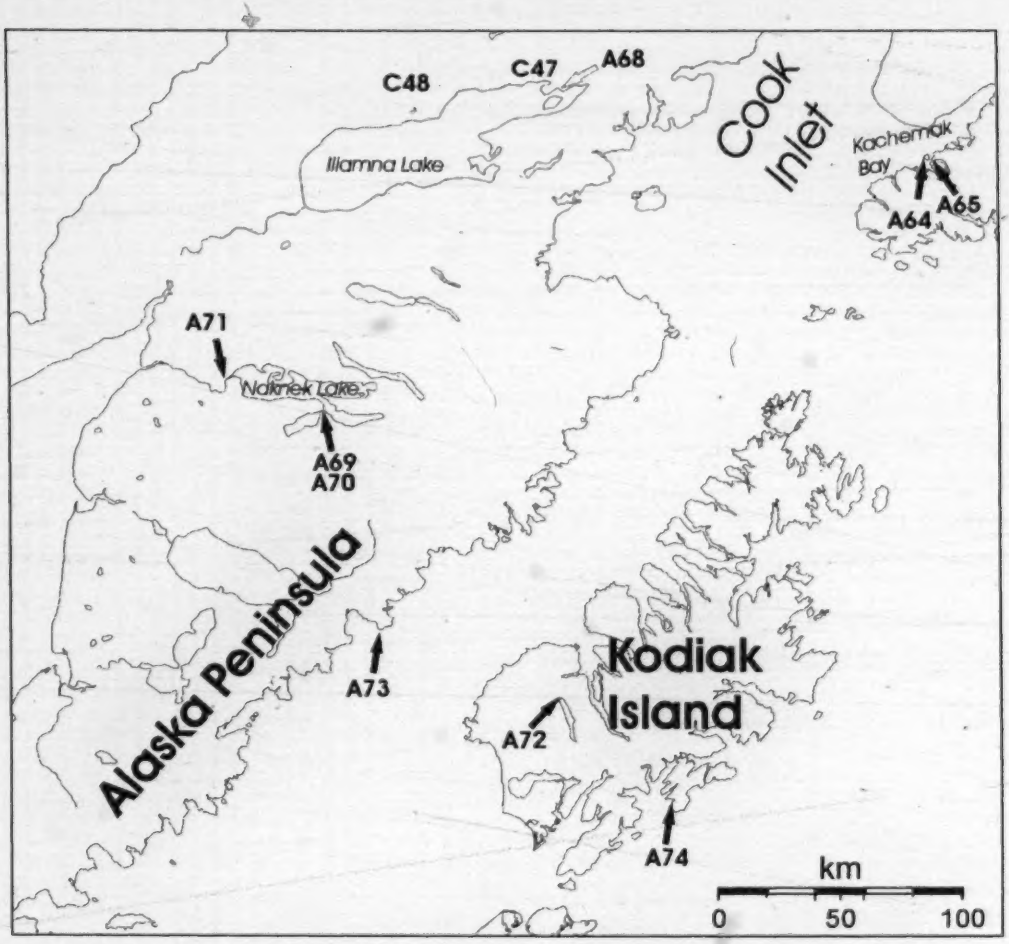

Figure 5.4 Potential native copper sources and archaeological sites with native copper artifacts in southwestern Alaska.

A = archaeological sites, C = potential sources of native copper.

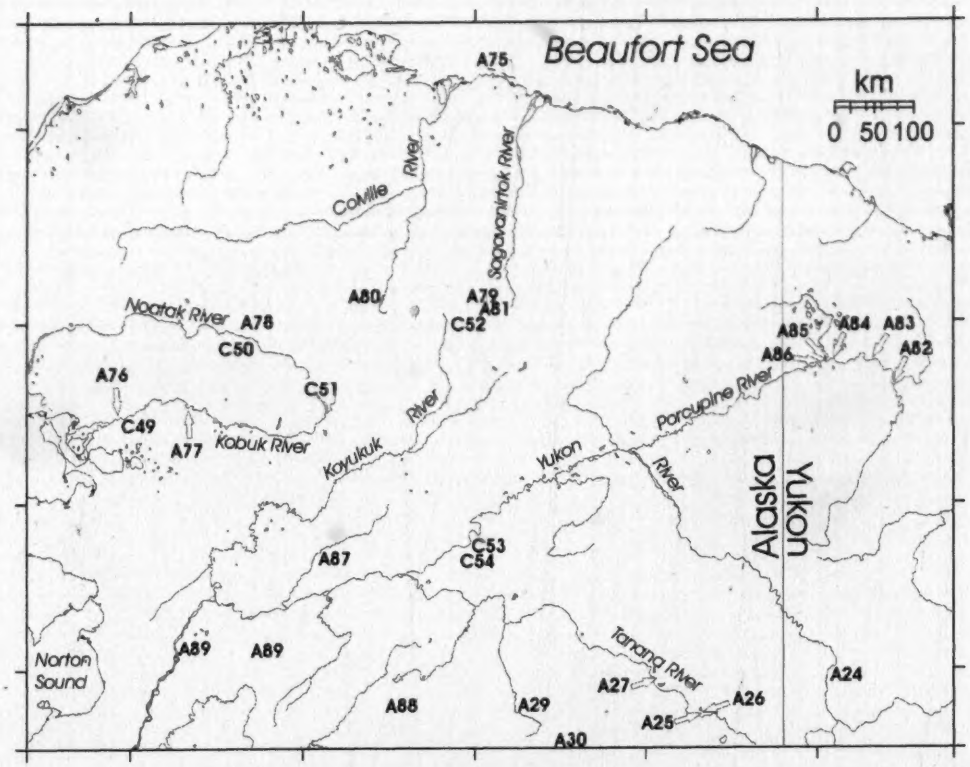

Figure 5.5 Potential native copper sources and archaeological sites with native copper in northern Yukon Territory and northern interior Alaska.

A = archaeological sites, C = potential sources of native copper.

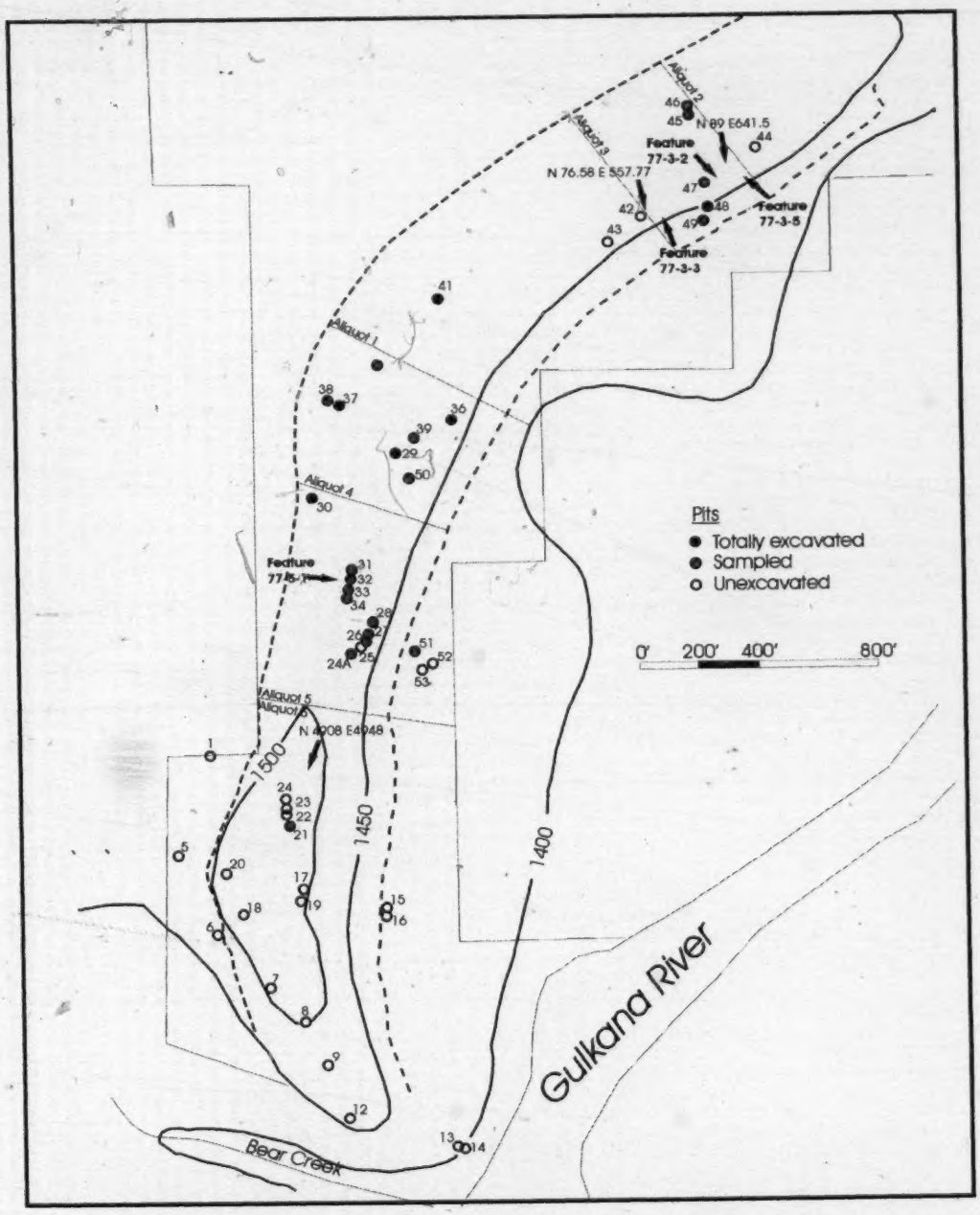

Figure 5.6 Map of GUL-077, the Gulkana Site, adapted from Workman 1976.

Figure 5.7 Decorative/Personal Adornment

Figure 5.8 By-Products (crimped sheet)

Figure 5.9 Cones

Figure 5.10 Spiral object from TNX-004 Accession #UA71-0035-0241.

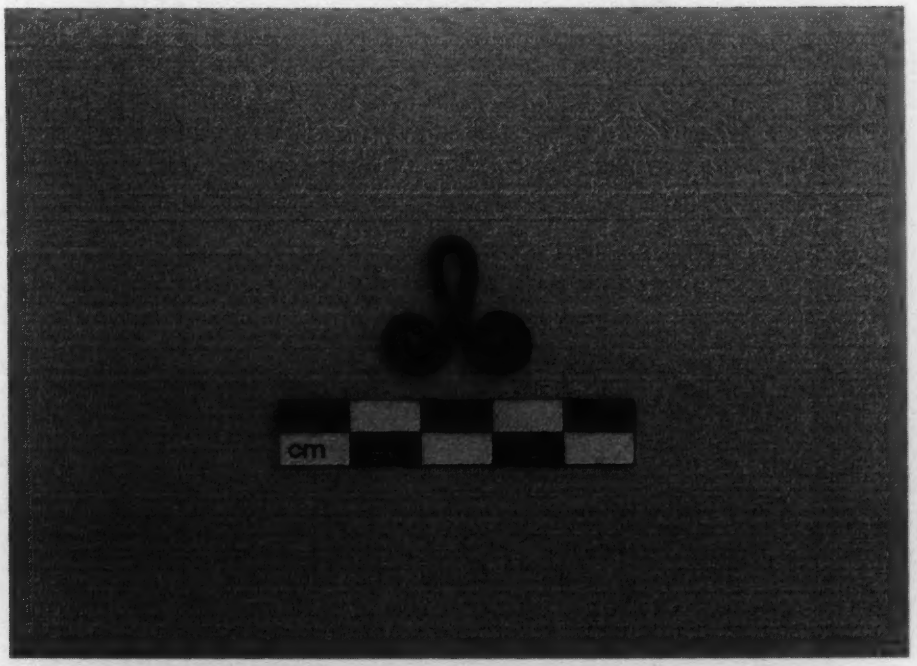

Figure 5.11 Spiral object from TNX-004 Accession #0069(01) -0510.

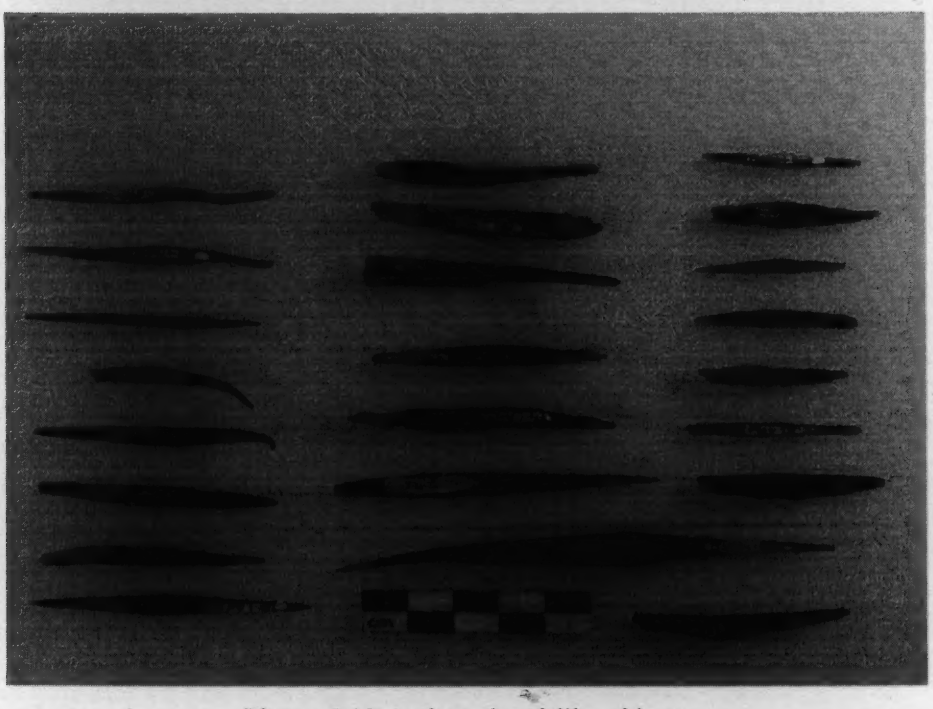

Figure 5.12 Awls and awl-like objects

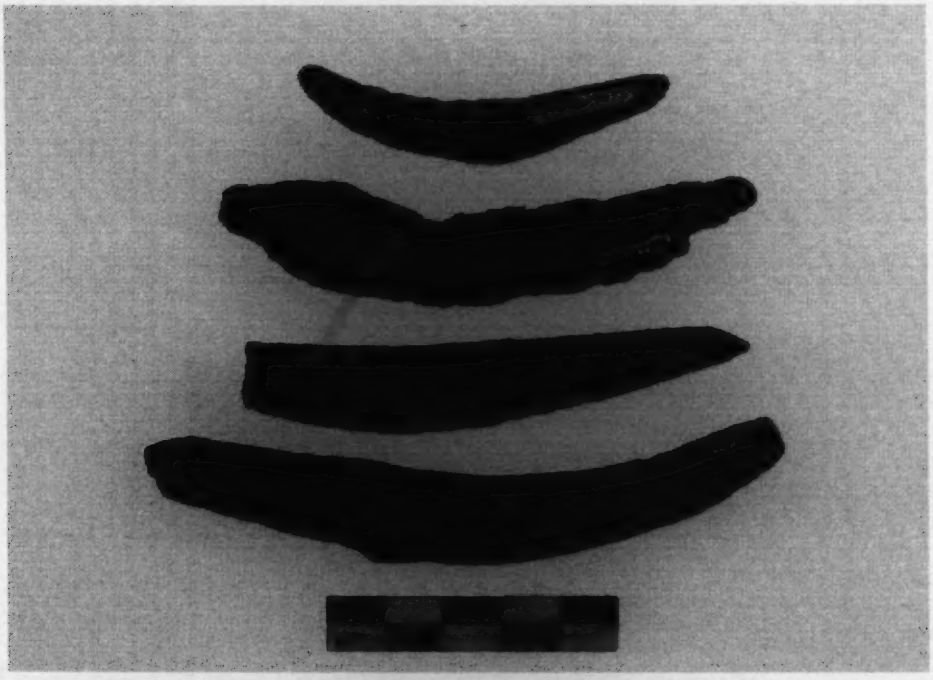

Figure 5.13 Large knives

Figure 5.14 Small knives

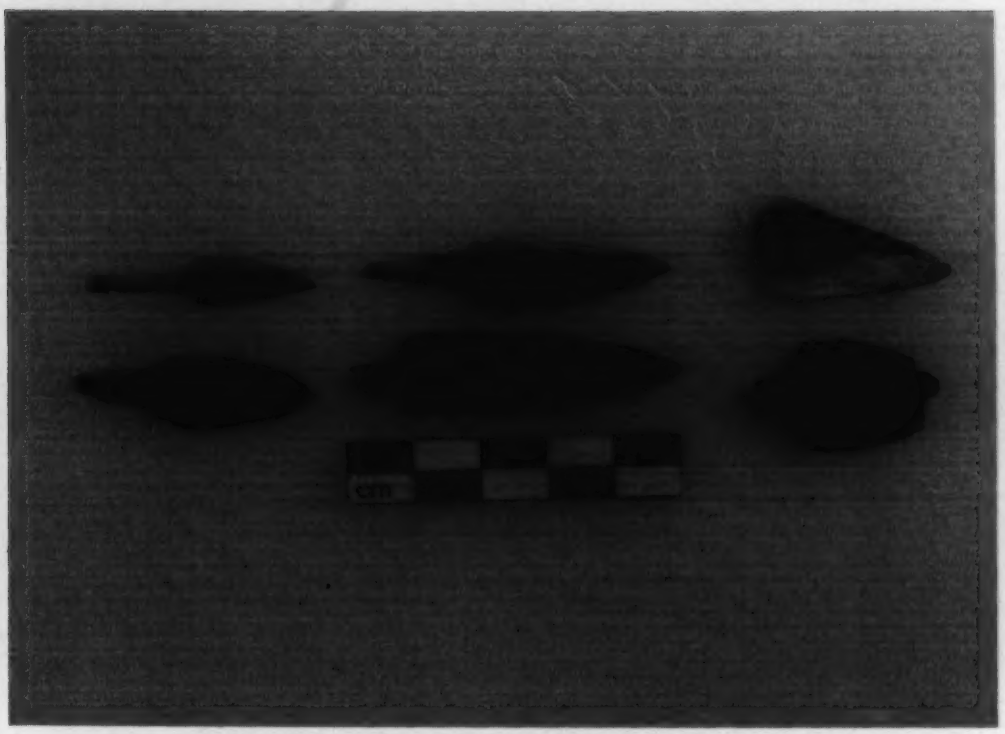

Figure 5.15 Projectile points

Chapter 6. Archaeometry

Introduction

Metallography, the study of the microstructure of metals, has become a routine component of archaeometallurgical research (Wayman 2004; Scott 1991) and several scholars have used metallography to interpret native copper technology (*e.g.*, Childs 1994; Clark and Purdy 1982; Franklin *et al.* 1981a, 1981b; Schroeder and Ruhl 1968; Vernon 1986, 1990; Wayman *et al.* 1985; Wayman *et al.* 1992). The results of metallographic analysis of native copper artifacts from GUL-077 are presented in the following section. Interpretation of the results and comparisons with other relevant material will be presented in Chapter 7. The provenance section of this chapter reports the results of trace element analysis on native copper artifacts and source material using two different techniques, Instrumental Neutron Activation Analysis (INAA) and Inductively Coupled Plasma Mass-Spectrometry (ICP-MS). Additionally, the findings of an assessment of the potential of using stable Pb-isotopic signatures to source native copper are presented.

Metallography of Artifacts from GUL-077

In this study samples from eight native copper artifacts from GUL-077 were examined using reflected light optical microscopy (Table 6.1). These samples were selected from the 24 samples that were subjected to INAA (see following section). A microscopic examination of this small subset was undertaken in order to corroborate their identification as native copper and make technological comparisons with previously analyzed material.

Samples were cut from each artifact using a jeweller's saw. Each sample was embedded in an epoxy mount, and prepared for metallographic examination using standard metallographic procedures (Scott 1991). These involved grinding on 320, 400 and 600 grit silicon carbide abrasive papers (water cooled and lubricated), followed by a two-stage polishing procedure: 6 micron diamond paste on nylon cloth with an oil-based coolant/lubricant, then 0.05 micron alumina suspension in water on short-napped cloth. The samples were examined using optical microscopy, first in the "as-polished" condition and then after etching using a 1:1

ammonium hydroxide/hydrogen peroxide etchant. Because all of the objects were sheet or relatively thin, the samples were purposely embedded and metallographic examinations carried out on cross-sections.

The polished sections of the copper objects were examined before etching in order to characterize any inclusions in the microstructure. As mentioned above, smelted copper (along with all other metals and alloys) always contains non-metallic inclusions (typically oxides and sulfides) that result from the smelting process. Naturally occurring (native) copper generally has a much lower abundance of non-metallic inclusions than does smelted copper. All eight samples were found by optical microscopy to have an extremely low abundance of non-metallic inclusions (the microstructures can be said to be very "clean" in this sense), which is indicative of naturally occurring native copper, rather than smelted (trade) copper.

When native copper is cold-worked the grain structure becomes distorted making it harder (a phenomenon called work-hardening) and more resistant to further working, so that eventually it starts to develop cracks from the edges and/or, in the case of sheet, in the plane of the sheet (delamination cracks). The way to avoid this cracking is to anneal the copper periodically during working (by heating the metal to a temperature above about 300° C for a few minutes); this procedure causes the individual copper grains to recrystallize. Recrystallization refers to the nucleation and growth of a new set of equiaxed strain-free grains at the expense of the previous elongated cold-worked grain structure. This can be observed in the microstructure using an optical microscope (Figure 6.1). The recrystallization removes the work hardening, softening the copper and restoring its malleability.

Thus, to carry out extensive shape changes it is necessary to subject the copper to a series of cold-working and annealing cycles (the alternative is to work the copper at a high temperature, but it is highly unlikely that was done in the case of these objects). The artifacts from GUL-077 all show evidence of annealing and/or folding. Evidence of folding itself is a good indication that the material was subjected to periods of annealing. Specimen 1-476 (Figure 6.2) has numerous laminations as a result of the repeated folding of a thin sheet of copper. The

presence of equi-axed grains indicates that the last thing to occur to this object was heating, *i.e.*, the material has recrystallized. Specimen 76-64 (Figure 6.3) has laminations whose surfaces are covered with a layer of oxide. This would be expected with heat-treated native copper, which would oxidize when heated in air, although alternatively, when the laminations are exposed at the surface, the oxidization could be due to corrosion. Specimen 76-91 (Figure 6.4) also has laminations/evidence of folding, as does specimen, 62-230 (Figure 6.1). The metal grains in this latter specimen show a pattern typical of annealing. Though grain size varies the grains themselves are relatively equi-axed and annealing twins are present, further evidence of recrystallization.

All of the GUL-077 material analyzed appears to have undergone a final heat treatment without further cold hammering. This may have been done intentionally, as part of the manufacturing process, but the heating of these objects could also have occurred either accidentally or as a result of forest fires at the site. Annealing can be inferred for the remaining four specimens (76-41, 65-208, 1357, 1-476), which were not examined metallographically, as they show no evidence of a work-hardened grain structure. Annealing is also indicated due to the amount of folding these objects likely underwent as evidenced by laminations.

Provenance

Provenance, or sourcing, studies are based on the hypothesis that an artifact's physical and chemical properties will be reflective of the original geologic deposit from which it was derived. In an archaeological context metals, lithics, and ceramics have all been successfully sourced to parent geological materials, or sources. Two routinely used techniques for determining the provenance of archaeological materials are isotope compositions and patterns of trace element concentrations, both of which are used to characterize a geologic deposit (Rapp 1985; Rapp and Hill 1998).

There are several methodological considerations in determining provenance using a geochemical approach. The first requires selecting the appropriate analytical technique to be used, this will depend to some extent on whether data are sought on

trace element concentrations or isotopic ratios. Isotopic ratios of carbon, oxygen, and strontium have been used to source marble (Rapp and Hill 1998). Pb isotope ratios have been used to source metals, particularly bronzes, though this has been controversial (*e.g.*, Budd *et al.* 1993; Gale and Stos-Gale 1992; Pernicka 1993; Reedy and Reedy 1992; Sayre *et al.* 1992). Because the isotopes of a single element differ from one another with regards to mass, a mass spectrometer is typically required to obtain data on isotope abundances or ratios. Trace elements are those present in geologic specimens in amounts less than 100 ppm (parts per million or ug/g by mass), though amounts less than 1000 ppm are often still referred to as trace elements. During the formation of geologic deposits trace elements can be either dispersed or concentrated during different phases of the geochemical process (Rapp 1985; Rapp and Hill 1998).

This study makes use of Inductively-Coupled Plasma Mass Spectrometry (ICP-MS), Laser Ablation (LA) Multi-Collector (MC) ICP-MS, and Instrumental Neutron Activation Analysis (INAA) to obtain information on both trace elements (ICP-MS and INAA) and isotope ratios (LA-MC-ICP-MS). The use of ICP-MS for material characterization has grown in recent years and it is now used in conjunction with Laser Ablation (LA-MC-ICP-MS). ICP-MS can be used to obtain both isotopic and trace element data and has been used specifically for provenance studies in archaeology. INAA has been widely applied to archaeological and geological source material in provenance studies for some 35 years and will be discussed further below (Henderson 2000; Rapp 1985).

The principles of NAA were discovered in 1936 by Von Hevesy and Levi, it was not until the development of nuclear reactors in the 1940s that this technique could be routinely used. By the 1950s NAA began to be applied to the study of ancient artifacts from both archaeological contexts and museums. In NAA a sample is bombarded by neutrons. This process of irradiation converts an extremely small fraction of the nuclei of the sample elements into radioactive nuclides (radionuclides). These radioactive nuclei decay typically emitting β^- particles and associated gamma radiation (γ rays). The specific gamma-ray energy(s) and their intensities are used to identify the particular elements and determine their

concentrations. The technique of NAA can be applied in the determination of some 70 of the 90 naturally occurring elements. While some elements may be determined at the part per billion, ppb (μg/kg) (Pollard and Heron 1996), or even part per trillion, ppt (ng/kg) level in a matrix-free, pure form, co-activation of a sample matrix generates background radiation that typically raises significantly the detection limts for elements in 'real world' samples. As an analytical technique advantages of NAA include its multi-elemental and non-destructive nature, the simplicity of sample preparation (with concomitant minimal risk of contamination) and the analysis of small samples (*e.g.*, 50 mg or less if need be for metals) (Rapp *et al.* 2000).

Another major consideration in any provenance study is the interpretation of the analytical results. This may require the use of statistical methods capable of eliciting meaningful patterns in isotope ratios or trace element signatures to differentiate similar sources or groups of artifacts. In this study the data analysis program Stata (Intercooled Stata 8.2 for Windows, 2005) was used to perform Principal Components Analysis (PCA), a form of Factor Analysis, of INAA and ICP-MS trace element data. PCA allows one to determine the variables (*i.e.*, elements), which are most important in accounting for the variability between populations (Kachigan 1991).

Two problems with the confident assignment of an artifact to a specific geologic source are (1) establishing that the artifact has not undergone chemical or physical processes that would significantly alter the original trace element pattern and (2) adequate sampling of all potentially relevant material sources (Rapp 1985; Rapp and Hill 1998). Adequate sampling of potentially relevant sources is crucial in order to determine the extent to which different trace element source signatures vary from one another.

Prior Provenance Studies in Northwestern North America

George Rapp has been a pioneer in attempts to source native copper using NAA, and the efforts of he and his colleagues have produced a large body of trace element data concerning the methodology of native copper provenance studies

(2000). The work of Rapp and his colleagues (2000) reports the analysis of 368 specimens of native copper from 17 well-defined sources in North America. In one phase of their study trace element data for 21 copper artifacts from three sites in Minnesota were compared to the trace element data from seven of the 17 North American sources that are within the western Great Lakes region. These 21 artifacts were sourced to five material localities, though two of the sources accounted for the majority of artifacts. However, when these same 21 artifacts were compared to the trace element data for all 17 sources included in the study, nine were then sourced to outside of the region; six to localities in Arizona and three to the Chititu Creek source in Alaska. It was considered highly unlikely that these specimens actually represented material from such distant sources leading Rapp to conclude that trace element sourcing studies must work within a "reasonable geographic framework of potential source deposits" (Rapp *et al.* 2000:96).

The results of Rapp *et al.* (2000) demonstrated that not all sources of native copper have a unique trace element signature. As chemical data have been amassed for other materials of archaeological interest the initial promise of unequivocal sourcing of such materials has been shown to be wishful thinking. This is particularly the case when analyzing materials that are generally quite pure, and therefore might be expected to apply to native copper, which is typically 99+% copper. In the case of sourcing studies of ceramics and obsidian, the number and also variability between sources of readily determined trace elements is far greater than in native copper.

Experiments by Wayman and Duke (1999:55) demonstrated that when native copper is liquefied some mercury is lost and silver becomes homogenized, the trace elements content is otherwise "relatively unaffected." Additionally, the heating of native copper below its melting point, *i.e.*, during annealing, is not expected to have an effect on its trace element content. Because there is no evidence that native copper, with a melting point of 1083° C, was melted by indigenous groups in northwestern North America prehistorically, the trace element content of native copper artifacts should accurately reflect the trace element content of native

copper source material and the melting effects noted by Wayman and Duke (1999) should have no bearing on this study.

Included in the study of Rapp *et al.* (2000) was the trace element analysis of native copper from Chititu Creek in Wrangell-St. Elias National Park and Preserve (WRST-NP/P). Though no artifacts from Alaska or northwestern Canada were analyzed, their research demonstrated that with a high degree of reliability trace element analysis could: (1) source copper artifacts, (2) distinguish native copper deposits throughout North America from one another, and (3) differentiate between multiple native copper deposits within a single region that were associated with the same geologic occurrence. Additionally, it was determined that a minimum of 10 samples is required from a geologic source in order to develop a trace element "fingerprint" and assess within source variability (Rapp *et al.* 2000).

Trace element analyses have been performed on both copper artifacts and raw native copper from northwestern North America (Franklin *et al.* 1981a; Rapp *et al.* 2000; Veakis 1979; Witthoft and Eyman 1969). These analyses, however, have not successfully sourced copper artifacts within the current study area for a variety of reasons. The Rapp *et al.* (2000) work did not actually seek to source artifacts within northwestern North America and involved the sampling of only one of many potentially relevant copper sources. The analysis of copper artifacts from arctic and subarctic sites by Franklin *et al.* (1981a) included the analysis of 14 artifacts from the previously discussed prehistoric Ahtna occupation site, GUL-077. They found that the artifacts could be separated into two groups based on their arsenic contents. However, only two native copper source samples were analyzed from the Yukon Territory and none from Alaska and as they cautioned, arsenic can vary greatly within a single source (Franklin *et al.* 1981).

Witthoft and Eyman (1969) claim to have ruled out both the Copper River and Coppermine River regions as the source of copper used to make two Tlingit daggers. However, no information is provided regarding the number or origin of native copper specimens analyzed. Their conclusion is based upon the presence, absence, and relative amounts of various trace elements without the application of any statistical methods. No raw data from the emission spectroscopy are provided

leaving open the possibility that the daggers analyzed may not even be manufactured from native copper. The use of emission spectroscopy by Witthoft and Eyman (1969) is undoubtedly a problem due to the lack of trace element detection sensitivity.

Fieldwork

As mentioned earlier, adequate sampling is crucial when attempting to determine provenance of artifacts. The source material analyzed in this study was obtained from three localities in WRST-NP/P. I collected material from Kletsan Creek and Chititu Creek. Material from Dan Creek was provided by a local placer miner. Additional source material was sought at three other locations (Chisana Glacier, Glacier Creek, and Nugget Creek) but without success.

Such fieldwork is costly, time-consuming, and physically challenging. There are few, if any, sources of native copper in the park that could be accessed in a timely manner without a charter flight. With or without hiring a charter flight accessing areas reported to have native copper showings usually requires backpacking in rough terrain for several days (Figure 6.5). Though charter flights reduce to some extent the necessary amount of backcountry foot travel, it is not always possible to land close to potential sources with the result that one may still have to navigate over or around major streams, rivers, glaciers, and hike steep trails at high elevation. The material from Kletsan Creek would not have been acquired without the aid of helicopter transportation.

Chartering a small, fixed-wing aircraft for a drop off into the backcountry can cost from $200 to $350 an hour, with one-way flight times of between one to two hours. A helicopter is able to access potential native copper collecting sites more directly than fixed-wing, but helicopter use is expensive. An hour of helicopter time in south-central Alaska costs around $800. This figure is on top of the cost required to bring a helicopter to the work area and have it available, which could cost $1500 a day. The above air travel costs reflect the prices during my fieldwork performed in 2003 and 2004.

Once a locality with a relative abundance of native copper has been found the recovery of nuggets is not difficult. The Kletsan Creek material was found along approximately 30 m of a steep stream bank. Nuggets were found both along the bottom of the steep embankment near the running water and eroding out of the bank. The nuggets were contained in loose, poorly sorted sediment consisting of various sized particles of gravel, sand, and clay (Figures 6.6 and 6.7). Nuggets were collected by hand and with use of a trowel.

Though there are numerous locations throughout south-central Alaska, especially WRST-NP/P, and southwestern Yukon Territory where native copper has been reported, exact locations are not always provided in the geological literature. More common is the reporting of native copper being found at certain streams leaving one to search several kilometers of stream drainage. The amount of time available to conduct such a search is limited by the amount of food one can have flown in and carry. Despite the relatively few sources in the region represented for analysis, it was decided early on in the project that the analysis of multiple samples from a few sources would still be a significant contribution. As mentioned above, there has yet to be a study assessing the potential for differentiating sources in the region based on trace element patterns.

Material Analyzed

Artifacts

The 24 artifacts subjected to trace element analysis for this study are all from GUL-077, the Gulkana site (Figure 5.1 A34). Of these, 14 were previously subjected to NAA by Franklin *et al.* (1981a) and five were analyzed by Harritt (1998). Harritt's results have not been published and are not presented here. Because these 19 artifacts had previously had samples removed for analysis it was considered desirable to sample and analyze these artifacts again rather than create damage to other artifacts by sampling them. These 19 artifacts had been recovered from features throughout the site during work in the 1970s (Figure 5.6) (Workman 1976). An additional five artifacts were selected from material collected during test excavations in 1995 and 1996 (Hanson 1999). These last five were selected in order

to have samples from areas of the site not previously represented. Furthermore, two of these five, a projectile point and large sheet, were chosen specifically due to their unique morphology and, or, relatively large size, as it was thought that they might not be native copper. A subset of 10 of these 24 artifacts were selected for ICP-MS elemental analysis to obtain trace element data.

Source Material

The source material is from three different locations (stream drainages) in Wrangell-St. Elias National Park in south-central Alaska (Figure 5.1). Dan Creek (C29) and Chititu Creek (C30) both flow into the Nizina River, which in turn, flows into the Chitina River. Dan and Chititu Creeks both issue from the same ridge system a 10-15 kilometers apart. Kletsan Creek (C1) begins in Alaska, crosses over into the Yukon and crosses back into Alaska before entering the White River from the south. The Chititu Creek material was collected about 13 kilometers upstream from the creek mouth on the north side of the creek where Rex Creek and White Creek join to form Chititu Creek. The Dan Creek material was provided by a placer miner. The Kletsan Creek samples were collected from just upstream of where the creek crosses over into the Yukon.

Methods

INAA

Source material samples from Kletsan and Dan Creeks were cut using a jeweler's saw with steel blades, samples from Chititu Creek were cut using an electric rotary tool with Dedeco Cut-Off Discs (No. 3031). Artifact samples were cut using either a jeweler's saw or wire cutters. All samples were cleaned in aqua regia for one minute and then rinsed in 2x distilled water, then ethanol and allowed to air dry before being weighed and packaged for irradiation. Samples were then irradiated in the SLOWPOKE reactor at the University of Alberta at a thermal flux of 5×10^{11} neutrons per cm^2 per second for either 4 or 6 hours. Following irradiation samples were counted twice. The initial (short) count was performed for 20-30 minutes following a decay period of ~1 week. The second (long) count was performed for 6-24 hours following a decay of ~4 weeks. Gamma-ray

measurements were carried out using a hyperpure Ge detector coupled to a PC-based multi-channel analyzer. The statistical program Stata 8.2 was used to perform Principal Components Factor Analysis on the trace element data.

In INAA detection limits are dependent on individual sample mass, neutron flux, irradiation and counting times, and detector efficiency and counting geometry. In this study the mass of samples varied by a factor of about two (80 mg to 160 mg), and the long counting times were generally within a factor of two-and-a-half (20,000 to 50,000 seconds), although in some instances some samples were counted for up to 80,000 seconds (a factor of four difference in tct). Therefore, no single detection limit for a specific element can be given that applies to all samples. Each sample, because of its particular mass and count time employed, will have its own specific elemental detection limits for those elements under analysis. Because of this, only guideline detection limits for an average sample mass and counting time can be calculated. Standards used for both INAA and ICP-MS analysis were copper metal rods, CANMET SSC-1, SSC-2, SSC-3. In addition, for INAA the NIST (formerly NBS) standard 158 and CANMET standard CZN-1 were also used for calibration purposes.

ICP-MS

Copper samples (weighting between ~50 to ~100 milligrams) were dissolved in 8N HNO_3 (~5 ml) using Savillex beakers and placed on a hot plate (100°C) overnight. Solutions were subsequently diluted to a volume of 90 ml (1% HNO_3). Prior to ICP-MS analysis, an internal standard (indium) was added and sample solutions were diluted (with 1% HNO_3) by a factor of 10. Trace elemental concentrations were determined on a Perkin-Elmer Elan 6000 quadrupole ICP-MS.

Instrumental conditions were as follows: RF power of 1200W; dual detector mode; blank subtraction applied subsequent internal standard correction; measurement units cps (counts per second); auto lens on; 4 points calibration curve (0, 0.025, 0.050, 0.100 ppm for Na; 0, 0.25, 0.50, 1.00 ppm for Ca, Mg, Fe, K; 0, 0.005, 0.010, 0.020 ppm for rest elements); typical count rate for 10 ppb Pb solution 150,000 to 200,000 cps. The sample uptake rate was approximately 1 ml/minute with 35 sweeps/reading, 1 reading/replicate and 3 replicates. Dwell times were 10 to

20 milliseconds for all elements with the exception of As and Se (100 milliseconds each). The relative standard deviation (2 σ level) for Ag, As, Fe, Ni, Pb, and Zn are between 5-10%, whereas that for Se is between 15-20%.

LA-MC-ICP-MS - Pb Isotopes

Seven geological samples of native copper and the three CANMET copper rod standards were analyzed for Pb isotopes using LA-MC-ICP-MS. The seven geological samples were from: Centennial Mine and White Pine Mine in Michigan, the Coppermine River region of the Northwest Territories, Dan, Chititu, and Kletsan Creeks in Wrangell-St. Elias National Park in south-central Alaska, and Burwash Creek in the southwestern Yukon Territory. All ten samples were set in a single epoxy mount and polished for analysis.

Laser ablation Pb isotopic analyses were obtained using a Nd:YAG UP213 nm laser system (New Wave Research) coupled to the NuPlasma MC-ICP-MS at the University of Alberta Radiogenic Isotope Facility. Fragments of copper artifacts were ablated in a helium atmosphere (1.0 L/minute) using the following parameters: 20 to 40 seconds ablation time; 160 μm spot size; 20 Hz repetition rate; ~15 J/cm^2 energy density. The sample-out line from the laser ablation cell was 'y'-connected to the sample-out line from the desolvating nebulizing introduction system (DSN-100 from Nu Instruments) to allow for simultaneous aspiration of a dilute Tl solution. The latter was used to monitor and correct for instrumental mass bias of the measured Pb isotope ratios, similar to the procedure described by Simonetti *et al.* (2005). The Pb and Tl isotope ion signals were measured simultaneously using six Faraday collectors. The accuracy of the analytical protocol was evaluated by repeated analysis (n=10) of an amazonite feldspar in-house standard from the Broken Hill deposit, Australia. The average Pb isotope values obtained were statistically indistinguishable from those previously obtained by TIMS measurement for the ore from the Broken Hill deposit (Gulson 1984).

The three CANMET standards have a reported Pb concentration of 65.3±7.02 (SSC-1), 6.12±1.20 (SSC-2), and 4.58±1.51 (SSC-3) μg/g (ppm) of lead (uncertainties ± 1σ). The amount of lead present in all three standards was sufficient to obtain Pb isotope results by LA-MC-ICP-MS. However, no Pb isotopic data were

obtained on any of the native copper samples, indicating very low levels of lead in these samples. This was further corroborated by ICP-MS trace element analysis which demonstrated that of the 30 native copper samples analyzed, four had lead in amounts between 0.10 and 0.322 μg/g (ppm) while the remaining 26 samples had lead in amounts ≤ 0.1 μg/g (ppm). Based on these results lead isotope analysis is unlikely to be of use in native copper provenance studies.

Results

INAA trace element results are presented in Tables 6.2 (artifacts) and 6.3 (source material) and ICP-MS trace element results are listed in Table 6.4. Table 6.5 compares the results of trace element analysis of GUL-077 artifacts by Franklin *et al.* (1981a) using NAA and the analysis done in the present study using NAA and ICP-MS. As noted in other analyses of native copper, the source material analyzed here is very pure (≥99+% Cu). Silver (Ag) is ubiquitous, being present in all of the source material and artifacts analyzed. The trace element analysis also confirmed that all of the artifacts analyzed are native copper. Only one (75AMU-1-1104 Table 6.4) had significant amounts of a number of trace elements, but is still within the range of what could be expected from native copper.

In this study the only other trace elements consistently detected in appreciable amounts using INAA were selenium (Se), arsenic (As), and mercury (Hg), though trace amounts of scandium (Sc) and iron (Fe) were found in three samples each. The ICP-MS system produced analyses for several trace elements but only Ag, As, Fe, Se, and Zinc (Zn) were detected in amounts greater than 1 ppm. Though Hg could not be analyzed for using ICP-MS, similar to the results of INAA, As and Se demonstrated the greatest potential for source characterization.

The results of the Principal Components Analysis are plotted in Figures 6.8-6.10. Factor 1 is plotted on the X-axis and Factor 2 is plotted on the Y-axis. In Figure 6.8 Factor 1 has an eigenvalue of 1.30517 and is most heavily influenced by the presence of As and Hg. Factor 2 has an eigenvalue of 1.11504 and is most heavily influenced by the absence of Se and presence of Ag (see Table 6.7). Figure 6.8 reveals the overlap of all four groups (three sources and GUL-077 artifacts)

using four elements (Se, As, Hg, and Ag). There is a great deal of overlap with no separation of populations being discernible. Because Ag is ubiquitous, the analysis was performed again using only As, Se, and Hg (Figure 6.9). In Figure 6.9 Factor 1 has an eigenvalue of 1.28430 and is most heavily influenced by the presence of As and Hg. Factor 2 has an eigenvalue of 0.95361 and is most heavily influenced by the presence of Se (see Table 6.8). Figure 6.9 demonstrates the ability to distinguish the Kletsan Creek material from all of the other samples, *i.e.*, Dan and Chititu Creeks material and Gulkana artifacts using INAA data and PCA. As mentioned earlier, Dan Creek and Chititu Creek are about 10-15 kilometers apart both flowing out of sources in the same ridge system. Though the extent to which these two sources could be distinguished from one another based on trace elements was unknown, it is not surprising that their trace element patterns are similar. Some of the Kletsan Creek material has Se but none has Hg or As. Several of the samples from the other three groups have Hg or As, or both, and only one had Se.

Figure 6.10 displays the results of PCA using the ICP-MS trace element data on 19 elements (Cr, Pb, Au, Ir, W, Hf, Eu, La, Cs, Sb, In, Cd, Ag, Se, As, Zn, Ni, Co, Fe). Factor 1 has an eigenvalue of 7.64328 and is most heavily influenced by Eu, Co, and Fe. Factor 2 has an eigenvalue of 3.62050 and is most heavily influenced by W and Ir (see Table 6.9). Clearly the use of all of these elements at once is not useful for distinguishing between sources and additional analysis is warranted.

Franklin *et al.* (1981a) subjected 42 artifacts and eight samples of source material from Arctic and Subarctic North America to NAA at the University of Toronto SLOWPOKE Reactor Facility (for equipment and methods see Hancock 1976). Included in their analyzed material were 14 artifacts from GUL-077 (Workman 1976). According to their results the Gulkana artifacts could be separated into two groups based on the presence (n = 8) or absence (n=6) of arsenic (As). Franklin *et al.* (1981a:16) suggested that these two groupings might indicate the exploitation of two different sources or "collecting localities." However, no large collections of source material were analyzed and citing Broderick (1929), they caution that arsenic concentrations can vary widely within a single native copper

deposit. The two As-based groupings do not correspond to any temporal or spatial differences at the site. INAA performed on the same 14 artifacts undertaken during this study demonstrate that arsenic is present in trace amounts in at least three (75AMU-1-652, GUL077/76-84, GUL077/76-91) of the six artifacts where arsenic was not detected in the 1981 study.

Summary

Metallographic examination and trace element analysis of the artifacts from GUL-077 confirms that they were made of native copper and that annealing was an important technique used in the production of artifacts. Due to the number of potential sources of native copper in south-central Alaska and southwestern Yukon (see Chapter 3) the artifacts from GUL-077 cannot be attributed to any specific source. However, at this point it is possible to rule out Kletsan Creek as a likely source of the native copper for the artifacts analyzed from GUL-077 as the trace element pattern found in the artifacts more closely resembles that of the Dan and Chititu Creeks. A significant finding of this study was the very low levels of Pb present in the native copper analyzed. This was found using LA-MC-ICP-MS to obtain Pb isotope data as INAA cannot be used to analyze for Pb as a trace element due to the difficulty of activating Pb. Thus, the use of LA-MC-ICP-MS in this study has demonstrated the futility of attempting to use Pb to source native copper via both isotopic and elemental analysis.

The results are preliminary and do not allow for the definitive assignment of artifacts to a specific source. The results do indicate that there is potential for determining the provenance of native copper artifacts from archaeological sites within the region. However, analyses of additional source material from the study are will be necessary in order to assess the amount of trace element signature variation within the region. Such analyses would, in turn, be useful for determining the extent to which native copper from south-central Alaska and southwestern Yukon Territory could be distinguished from native copper from other regions, *i.e.*, Central Arctic and Subarctic Canada and the Northwest Coast.

Table 6.1 GUL-077 samples selected for metallographic examination.

ID #	Description	Comments
GUL77/76-41	bipoint	folding and oxidation of internal surface
GUL77/76-64	unfinished copper implement, blank	two folds
GUL77/76-91	by-product, sheet	folds from hammering
75AMU-1-476	by-product, rectangle	folds from hammering
75AMU-1-1357	single point	band of copper oxide
UA95-65-208	by-product, blade(?)	some nonmetallic inclusions
UA96-62-230	by-product, sheet	closed folded cracks
UA96-62-234	by-product, nugget	porosities, less hammered

Table 6.2 Results of INAA for GUL-077 artifacts, n.d. = not detected.

Catalog #	Feature/Unit	Description	Ag	Se	As	Hg
GUL077/76-33	77-3-2	by-product, sheet	157	n.d.	184	2
GUL077/76-41	77-3-2	bipoint	97	n.d.	n.d.	n.d.
GUL077/76-45	77-3-2	by-product, sheet	178	n.d.	n.d.	19
GUL077/76-55	77-3-2	by-product, sheet	139	n.d.	23	4
GUL077/76-64	77-3-2	blank	52	n.d.	n.d.	n.d.
GUL077/76-73	77-3-3	by-product, sheet	132	n.d.	14	3
GUL077/76-77	77-3-4	perforator	171	n.d.	136	2
GUL077/76-84	77-3-5	rectangle	783	n.d.	8	2
GUL077/76-91	77-6-1	by-product, sheet	210	n.d.	12	6
75AMU-1-447	Pit 29	by-product, sheet	260	n.d.	857	41
75AMU-1-457	Pit 29	knife	227	n.d.	n.d.	1
75AMU-1-473	Pit 29	by-product, sheet	217	n.d.	n.d.	6
75AMU-1-476	Pit 29	rectangle	159	n.d.	262	6
75AMU-1-652	Pit 50	by-product, sheet	180	n.d.	49	4
75AMU-1-1088	77-4-LB3	cone	175	n.d.	19	5
75AMU-1-1089	Pit 29	by-product, sheet	158	n.d.	n.d.	n.d.
75AMU-1-1103	Pit 29	by-product, sheet	67	n.d.	485	3
75AMU-1-1104	Pit 29	nugget, worked	798	n.d.	n.d.	2
75AMU-1-1357	77-5-1	single point	745	n.d.	n.d.	n.d.
UA95-65-0208	N225 E698	blade	191	n.d.	5	2
UA95-65-0261	N102 E653	rectangle	240	n.d.	n.d.	5
UA96-62-0229	N225 E698	projectile point	114	n.d.	n.d.	n.d.
UA96-62-0230	MDS #54	by-product, sheet	923	n.d.	8	8
UA96-62-0234	MDS #53	nugget, worked	142	7	n.d.	n.d.

Table 6.3 Source material INAA results, n.d. = not detected.

Source	ID #	Ag	Se	As	Hg
Kletsan Creek	KC-A-1a	350	2	n.d.	n.d.
Kletsan Creek	KC-A-1b	320	1	n.d.	n.d.
Kletsan Creek	KC-A-2	218	3	n.d.	n.d.
Kletsan Creek	KC-A-3	1063	n.d.	n.d.	n.d.
Kletsan Creek	KC-A-4	179	n.d.	n.d.	n.d.
Kletsan Creek	KC-A-5	190	n.d.	n.d.	n.d.
Kletsan Creek	KC-A-6	119	2	n.d.	n.d.
Kletsan Creek	KC-A-7	534	3	n.d.	n.d.
Kletsan Creek	KC-A-8	205	n.d.	n.d.	n.d.
Kletsan Creek	KC-A-9	94	n.d.	n.d.	n.d.
Kletsan Creek	KC-A-10	180	2	n.d.	n.d.
Kletsan Creek	KC-A-11	87	5	n.d.	n.d.
Kletsan Creek	KC-A-12	103	7	n.d.	n.d.
Kletsan Creek	KC-A-13	179	n.d.	n.d.	n.d.
Kletsan Creek	KC-A-14	114	25	n.d.	n.d.
Kletsan Creek	AE-1	62	n.d.	n.d.	n.d.
Kletsan Creek	AE-3	171	n.d.	n.d.	n.d.
Dan Creek	KC-B-1a	124	n.d.	n.d.	3
Dan Creek	KC-B-1b	107	n.d.	n.d.	1
Dan Creek	KC-B-2	117	n.d.	16	28
Dan Creek	KC-B-3	179	n.d.	127	n.d.
Dan Creek	KC-B-4	186	n.d.	n.d.	n.d.
Dan Creek	KC-B-5	76	n.d.	49	2
Dan Creek	KC-B-6	282	n.d.	n.d.	28
Dan Creek	KC-B-7	211	n.d.	n.d.	2
Dan Creek	KC-B-8	334	n.d.	n.d.	58
Dan Creek	KC-B-9	123	n.d.	4	1
Dan Creek	KC-B-10	100	n.d.	n.d.	1
Dan Creek	KC-B-11	66	n.d.	491	2
Dan Creek	KC-B-12	167	n.d.	n.d.	n.d.
Dan Creek	KC-B-13	98	n.d.	9	1
Dan Creek	KC-B-14	141	n.d.	n.d.	6
Dan Creek	KC-B-15	536	n.d.	n.d.	35
Dan Creek	KC-B-16	161	n.d.	237	253
Chititu Creek	KC-E-1	223	n.d.	n.d.	20
Chititu Creek	KC-E-2	45	n.d.	n.d.	2
Chititu Creek	KC-E-3	346	n.d.	n.d.	1
Chititu Creek	KC-E-4	149	n.d.	n.d.	2
Chititu Creek	KC-E-5	78	n.d.	n.d.	n.d.
Chititu Creek	KC-E-6	184	n.d.	14	5
Chititu Creek	KC-E-7	77	n.d.	16	2

Table 6.4 ICP-MS trace element results, n.d. = not detected.

Description	ID #	Cr	Fe	Co	Ni	Zn	As	Se	Ag	Cd	In
Kletsan Creek	K-1	0.885	72.128	0.009	0.335	2.541	0.195	2.128	249.5	0.003	0.002
Kletsan Creek	K-2	0.754	60.499	0.005	0.493	2.258	1.121	0.207	58.8	0.009	0.000
Kletsan Creek	K-3	0.614	45.571	0.005	0.232	1.792	0.033	2.575	377.0	0.003	0.000
Kletsan Creek	K-4	0.618	53.074	0.006	0.321	1.662	n.d.	1.095	901.1	0.007	0.001
Kletsan Creek	K-5	0.563	48.202	0.004	0.343	1.904	0.240	7.809	241.4	0.004	0.000
Kletsan Creek	K-6	0.593	66.982	0.004	0.472	1.933	1.491	0.204	73.1	0.004	0.000
Kletsan Creek	K-7	0.563	50.844	0.004	0.301	1.561	0.000	0.147	1627.0	0.006	0.000
Kletsan Creek	K-8	0.455	37.765	0.003	0.180	1.527	0.178	0.917	217.2	0.003	0.000
Kletsan Creek	K-9	0.600	66.44	0.019	0.373	1.758	25.22	0.312	218.9	0.003	0.000
Kletsan Creek	K-10	0.394	35.6	0.025	18.394	1.850	0.009	0.244	680.7	n.d.	0.002
Dan Creek	D-1	0.770	41.4	0.005	0.232	1.423	193.9	0.337	188.1	0.001	0.000
Dan Creek	D-2	0.383	38.0	0.002	0.241	1.411	0.26	0.271	316.2	n.d.	0.000
Dan Creek	D-3	0.718	118.8	0.035	0.305	2.007	46.57	0.418	146.6	0.000	0.000
Dan Creek	D-4	0.550	60.5	0.010	0.633	1.627	18.52	0.485	177.6	n.d.	n.d.
Dan Creek	D-5	0.448	35.7	0.003	0.191	1.465	1.03	0.325	370.3	0.001	0.000
Dan Creek	D-6	2.279	717.8	0.547	3.739	2.630	274.9	10.187	188.9	0.003	n.d.
Chititu Creek	C-1	0.484	39.7	0.006	0.202	3.969	3.69	0.315	503.3	0.002	n.d.
Chititu Creek	C-4	0.776	72.4	0.004	0.312	1.959	1.27	0.432	282.4	0.001	n.d.
Chititu Creek	C-5	0.422	37.811	0.004	0.153	1.405	1.86	0.550	156.2	0.000	0.001
Chititu Creek	C-6	0.515	48.358	0.002	0.310	1.730	4.24	0.452	367.5	n.d.	n.d.
Standard #1	S-1	0.630	89.287	0.037	12.630	21.733	0.86	6.437	33.2	n.d.	0.001
Standard #3	S-3	2.645	69.077	0.196	35.704	6.387	5.95	3.132	25.9	0.032	n.d.
GUL-077	GUL077/76-41	0.486	48.033	0.004	0.186	1.500	0.01	0.400	155.3	0.011	n.d.
GUL-077	GUL077/76-73	0.466	48.176	0.002	0.237	1.571	14.65	0.395	222.4	0.006	n.d.
GUL-077	GUL077/76-77	0.534	51.522	0.004	0.538	1.535	98.20	0.503	239.8	0.001	n.d.
GUL-077	75AMU-1-473	0.373	41.531	0.006	0.220	1.588	0.65	0.399	313.9	0.025	n.d.
GUL-077	75AMU-1-476	0.385	37.848	0.003	0.165	1.336	223.43	0.412	262.0	0.010	n.d.
GUL-077	75AMU-1-652	0.985	93.426	0.008	0.942	2.876	47.051	0.708	161.4	0.014	0.002
GUL-077	75AMU-1-1104	1.782	900.576	1.150	4.754	141.694	1.632	0.542	1113.0	0.039	0.004
GUL-077	75AMU-1-1089	0.379	80.727	0.077	0.293	1.522	0.078	0.446	232.7	0.003	0.000
GUL-077	UA95-65-0261	0.555	56.315	0.002	0.201	1.497	0.420	0.557	355.9	0.003	n.d.
GUL-077	UA96-62-229	0.360	45.095	0.007	0.628	1.608	0.067	0.367	149.1	n.d.	n.d.

Table 6.4 ICP-MS trace element results, continued

Description	ID #	Sb	Cs	La	Eu	Hf	W	Ir	Au	Pb
Kletsan Creek	K-1	0.463	0.012	0.013	0.001	0.037	0.597	0.002	0.186	0.155
Kletsan Creek	K-2	0.112	0.003	0.026	0.001	0.019	0.233	n.d.	0.057	0.061
Kletsan Creek	K-3	0.036	0.002	0.008	0.000	0.009	0.093	n.d.	0.022	0.056
Kletsan Creek	K-4	0.024	n.d.	0.017	0.000	0.008	0.162	n.d.	0.011	0.076
Kletsan Creek	K-5	0.013	n.d.	0.040	0.001	0.007	0.032	n.d.	0.006	0.082
Kletsan Creek	K-6	0.005	0.001	0.029	0.002	0.015	0.019	n.d.	0.000	0.061
Kletsan Creek	K-7	0.009	n.d.	0.020	0.000	0.003	0.006	n.d.	0.010	0.031
Kletsan Creek	K-8	0.000	n.d.	0.017	0.000	0.003	0.010	n.d.	0.002	0.038
Kletsan Creek	K-9	n.d.	n.d.	0.032	0.001	0.002	0.004	n.d.	n.d.	0.062
Kletsan Creek	K-10	0.211	0.005	0.010	0.000	0.015	0.195	n.d.	0.070	0.086
Dan Creek	D-1	0.061	0.001	0.012	0.001	0.016	0.070	n.d.	0.024	0.027
Dan Creek	D-2	0.024	n.d.	0.010	0.000	0.003	0.033	n.d.	0.012	0.022
Dan Creek	D-3	0.035	n.d.	0.017	0.001	0.005	0.080	n.d.	0.007	0.047
Dan Creek	D-4	0.009	n.d.	0.008	0.000	0.002	n.d.	n.d.	n.d.	0.028
Dan Creek	D-5	n.d.	n.d.	0.008	0.000	0.001	n.d.	n.d.	n.d.	0.013
Dan Creek	D-6	0.038	0.014	0.038	0.011	0.010	0.039	n.d.	n.d.	0.066
Chititu Creek	C-1	0.042	n.d.	0.027	0.000	0.002	n.d.	n.d.	n.d.	0.070
Chititu Creek	C-4	0.038	n.d.	0.055	0.000	0.071	0.004	n.d.	n.d.	0.080
Chititu Creek	C-5	0.226	0.004	0.023	0.000	0.026	0.226	n.d.	0.050	0.028
Chititu Creek	C-6	0.135	n.d.	0.047	0.001	0.017	0.087	n.d.	0.023	0.042
Standard #1	S-1	2.110	n.d.	0.031	0.000	0.010	0.127	n.d.	0.023	51.558
Standard #3	S-3	0.256	n.d.	0.016	0.000	0.008	0.026	n.d.	0.001	4.222
GUL-077	GUL077/76-41	0.062	n.d.	0.008	0.000	0.005	0.008	n.d.	0.159	0.022
GUL-077	GUL077/76-73	0.093	n.d.	0.008	0.000	0.005	0.008	n.d.	0.006	0.322
GUL-077	GUL077/76-77	0.049	n.d.	0.008	0.000	0.005	0.010	n.d.	n.d.	0.102
GUL-077	75AMU-1-473	0.136	n.d.	0.014	0.000	0.003	n.d.	n.d.	0.114	0.146
GUL-077	75AMU-1-476	0.071	n.d.	0.014	0.000	0.001	n.d.	n.d.	0.106	0.087
GUL-077	75AMU-1-652	0.645	0.007	0.013	0.000	0.055	0.445	n.d.	1.072	0.088
GUL-077	75AMU-1-1104	0.136	0.007	0.144	0.030	0.046	0.148	n.d.	0.265	0.666
GUL-077	75AMU-1-1089	0.048	0.000	0.006	0.000	0.007	0.034	n.d.	0.029	0.016
GUL-077	UA95-65-0261	0.602	n.d.	0.011	0.000	0.009	0.042	n.d.	0.125	0.118
GUL-077	UA96-62-229	0.056	n.d.	0.013	0.001	0.004	0.015	n.d.	0.024	0.089

Table 6.5 Results of trace element analysis GUL-077 artifacts. n.d. = not detected, NAA-81 = Franklin *et al.* (1981a) - Cu concentrations exceeded 90%.

Catalog #	Analysis	Fe	Ni	Zn	Hg	As	Se	Ag	Sb	Au	Pb	Sn
GUL077/76-33	NAA-06				2	184	n.d.	157				
GUL077/76-33	NAA-81					0.02±0.001%		≤0.1%	trace	trace		≤0.86%
GUL077/76-41	NAA-06				n.d.	n.d.	n.d.	97				
GUL077/76-41	NAA-81					≤0.003%		≤0.11%	trace	trace		≤0.94%
GUL077/76-41	ICP-MS	48.033	0.186	1.500		0.01	0.400	155.3	0.062	0.159	0.022	
GUL077/76-45	NAA-06				19	n.d.	n.d.	178				
GUL077/76-55	NAA-06				4	23	n.d.	139				
GUL077/76-55	NAA-81					≤0.003%		≤0.08%	trace	trace		≤0.78%
GUL077/76-64	NAA-06				n.d.	n.d.	n.d.	52				
GUL077/76-73	NAA-06				3	14	n.d.	132				
GUL077/76-73	NAA-81					≤0.004%		≤0.11	trace	trace		≤0.99%
GUL077/76-73	ICP-MS	48.176	0.237	1.571		14.65	0.395	222.4	0.093	0.006	0.322	
GUL077/76-77	NAA-06				2	136	n.d.	171				
GUL077/76-77	NAA-81					0.01±0.001%		n.d.				≤0.65%
GUL077/76-77	ICP-MS	51.522	0.538	1.535		98.20	0.503	239.8	0.049	-0.001	0.102	
GUL077/76-84	NAA-06				2	8	n.d.	783				
GUL077/76-84	NAA-81					n.d.		≤0.09%	trace	trace		≤0.77%
GUL077/76-91	NAA-06				6	12	n.d.	210				
GUL077/76-91	NAA-81					n.d.		≤0.07%	trace	trace		≤0.58%
75AMU-1-447	NAA-06				41	857	n.d.	260				
75AMU-1-447	NAA-81					0.14±0.002%		≤0.08%	trace	trace		≤0.77%
75AMU-1-457	NAA-06				1	n.d.	n.d.	227	trace	trace		
75AMU-1-473	NAA-06				6	n.d.	n.d.	217				
75AMU-1-473	NAA-81					n.d.		≤0.08%	trace	trace		0.85±0.22%
75AMU-1-473	ICP-MS	41.531	0.220	1.588		0.65	0.399	313.9	0.136	0.114	0.146	
75AMU-1-476	NAA-06				6	262	n.d.	159				
75AMU-1-476	NAA-81					0.02±0.001%		≤0.07%	trace	trace		≤0.73%
75AMU-1-476	ICP-MS	37.848	0.165	1.336		223.43	0.412	262.0	0.071	0.106	0.087	
75AMU-1-652	NAA-06				4	49	n.d.	180				
75AMU-1-652	NAA-81					n.d.		≤0.1%	trace	trace		≤0.82%
75AMU-1-652	ICP-MS	93.426	0.942	2.876		47.051	0.708	161.4	0.645	1.072	0.088	

75AMU-1-1088	NAA-06				5	19	n.d.	175				
75AMU-1-1089	NAA-06				n.d.	n.d.	n.d.	158				
75AMU-1-1089	NAA-81					n.d.		n.d.	trace	trace		≤0.58%
75AMU-1-1089	ICP-MS	80.727	0.293	1.522		0.078	0.446	232.7	0.048	0.029	0.016	
75AMU-1-1103	NAA-06				3	485	n.d.	67				
75AMU-1-1103	NAA-81					0.08±0.002%		n.d.	trace	trace		≤0.74%
75AMU-1-1104	NAA-06				2	n.d.	n.d.	798				
75AMU-1-1104	ICP-MS	900.576	4.754	141.694		1.632	0.542	1113.0	0.136	0.265	0.666	
75AMU-1-1357	NAA-06				n.d.	n.d.	n.d.	745				
75AMU-1-1357	NAA-81					n.d.		0.17±0.02%	trace	trace		≤0.63%
UA95-65-0208	NAA-06				2	5	n.d.	191				
UA95-65-0261	NAA-06				5	n.d.	n.d.	240				
UA95-65-0261	ICP-MS	56.315	0.201	1.497		0.420	0.557	355.9	0.602	0.125	0.118	
UA96-62-0229	NAA-06				n.d.	n.d.	n.d.	114				
UA96-62-0229	ICP-MS	45.095	0.628	1.608		0.067	0.367	149.1	0.056	0.024	0.089	
UA96-62-0230	NAA-06				8	8	n.d.	923				
UA96-62-0234	NAA-06				n.d.	n.d.	7	142				

Table 6.6 Reported results for CANMET Standards and results of INAA and ICP-MS analysis.

Element	SSC-1	INAA	ICP-MS	SSC-2	INAA	SSC-3	INAA	ICP-MS
Ag	18.8±5.81	19.7	33.2	13.9±3.38	13.5	16.1±3.59	15.2	25.9
As	1.16±0.483	n.d.	0.86	1.18±0.612	n.d.	5.45±1.93	6.45	5.95
Fe	39.2±7.18	n.d.	89.287		n.d.	40±8.82	n.d.	69.077
Ni	17.6±3.36	n.d.	12.630		n.d.	48±7.68	n.d.	35.704
Pb	65.3±7.02	n.d.	51.558		n.d.	4.58±1.51	n.d.	4.222
Se	7.28±1.61	7.2	6.437	2.58±0.82	2.6	3.87±0.744	3.95	3.132
Zn	33.3±7.91	31.6	21.733	16.3±5.15	16.9	15.3±3.60	15.4	6.387

Table 6.7 PCA for INAA corresponding to Figure 6.8.

Factor	Eigenvalue	Variable Loadings			
		Se	Ag	As	Hg
1	1.30517	-0.26763	-0.28771	0.70549	0.58981
2	1.11501	-0.61292	0.73700	-0.13958	0.24834
3	0.90096	0.71146	0.38186	-0.06461	0.58637
4	0.67883	0.21570	0.47774	0.58637	-0.49660

Table 6.8 PCA for INAA corresponding to Figure 6.9.

Factor	Eigenvalue	Variable Loadings		
		Se	As	Hg
1	1.28430	-0.37755	0.66146	0.64802
2	0.95361	0.92388	0.22189	0.31178
3	0.76209	0.06244	0.71641	-0.69488

Table 6.9 PCA for ICP-MS corresponding to Figure 6.10.

Factor		1	2	3	4
Eigenvalue		7.64328	3.62050	2.43786	1.36473
Variable Loadings	Cr	0.79355	-0.14993	0.52562	-0.07022
	Pb	0.81219	-0.10669	-0.34088	-0.12266
	Au	0.36434	0.66522	0.03718	-0.40575
	Ir	0.02477	0.80431	-0.10815	0.26264
	W	0.34339	0.87603	0.15278	0.06617
	Hf	0.51781	0.44708	-0.00977	-0.33430
	Eu	0.94510	-0.28227	-0.04903	0.00417
	La	0.83977	-0.26565	-0.21549	-0.08158
	Cs	0.63048	0.40667	0.56058	0.24345
	Sb	0.22545	0.75880	0.07422	-0.28288
	In	0.67499	0.49863	-0.17999	0.36632
	Cd	0.73101	-0.02897	-0.34155	-0.26460
	Ag	0.37393	-0.14636	-0.44595	0.41178
	Se	0.24030	-0.19285	0.75881	0.14763
	As	0.11974	-0.27844	0.72856	-0.12238
	Zn	0.89326	-0.18197	-0.35744	-0.02784
	Ni	0.30574	0.13131	0.02905	0.66164
	Co	0.93857	-0.30956	0.02435	0.02144
	Fe	0.90195	-0.32665	0.23785	-0.00471

Figure 6.1 Optical micrograph showing grain structure of sample 62-230, etched using 1:1 ammonium hydroxide/hydrogen peroxide, magnification 85x.

Figure 6.2 Optical micrograph of sample 1-476, note oxide scale on the surfaces of the laminations, un-etched, magnification 85x.

Figure 6.3 Optical micrograph of sample 76-64, note laminations, un-etched, magnification 85x.

Figure 6.4 Optical micrograph of sample 76-91, note laminations and oxide scale, un-etched, magnification 55x.

Figure 6.5 Camp on Glacier Creek, WRST-NP/P.

Figure 6.6 Native copper nugget at Kletsan Creek, above arrow and to the left of the compass.

Figure 6.7 Native copper nugget at Kletsan Creek, right of trowel.

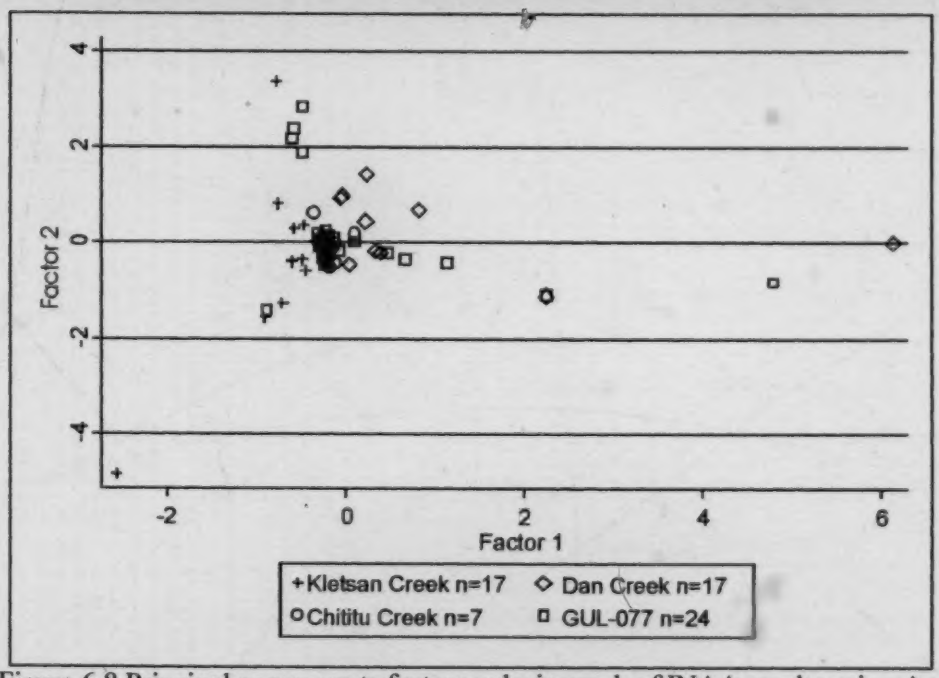

Figure 6.8 Principal components factor analysis graph of INAA results using Ag, As, Se, Hg.

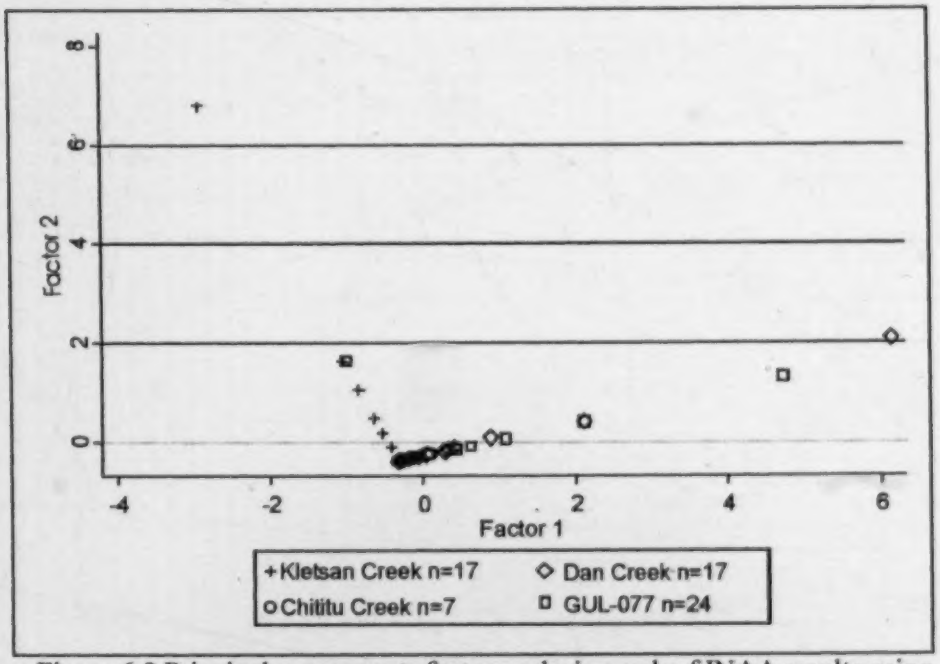

Figure 6.9 Principal components factor analysis graph of INAA results using As, Hg, and Se.

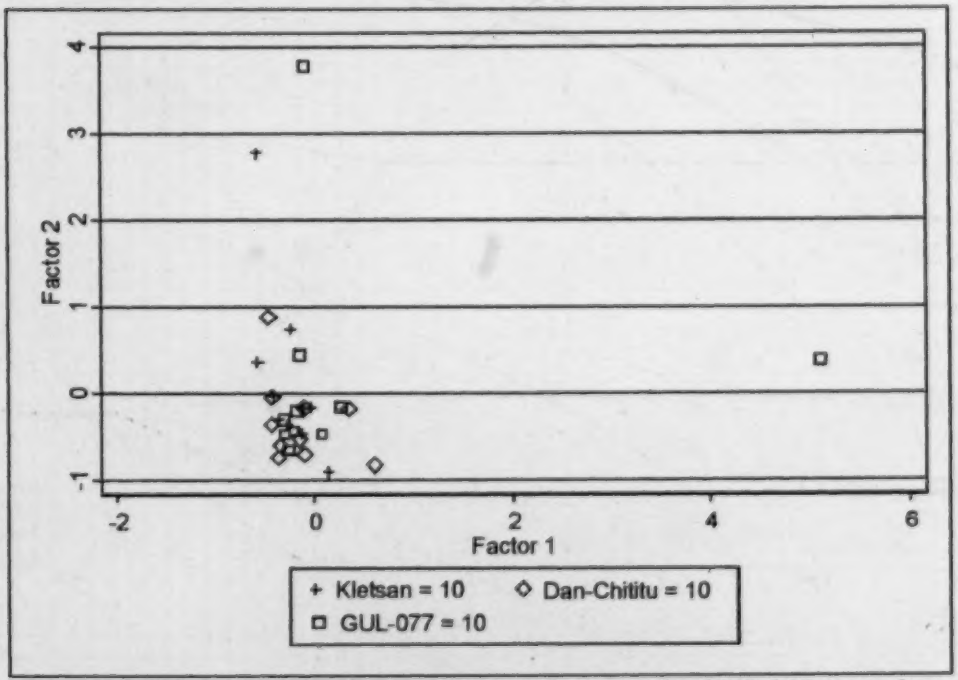

Figure 6.10 Principal components factor analysis graph of ICP-MS trace element results. See Table 6.4 for elements used.

Chapter 7. The Anthropology of Athapaskan Native Copper Technology

Though several indigenous groups in Alaska and the Yukon used native copper, this chapter will focus on Athapaskan native copper metallurgy of south-central Alaska and southwestern Yukon. Any attempt to contextualize the use of native copper by Athapaskan groups in Alaska and the Yukon requires a basic understanding of northern Athapaskan technology. This chapter provides an overview and characterization of northern Athapaskan technology. This generalized view of northern Athapaskan technology is used with archaeological, archaeometric, and ethnohistoric data to examine the use of native copper within an anthropology of technology framework that focuses on the concepts of technological choice (Sillar and Tite 2000) and prestige technology (Hayden 1998), both outlined in Chapter 2. This combined approach to the study of the use of native copper will then be used to examine the value of native copper to indigenous groups in the region, which will, in turn, lay the groundwork for examining the relationship between the value of native copper and social complexity in Chapter 8. This chapter ends with a discussion of the origin of Ahtna metallurgy and metallurgy in general.

Athapaskan Technology

In Chapter 2 a quotation was provided from Ridington (1982:471), who, in expressing his de-emphasis on the material aspect of northern Athapaskan technology, stated "technology should be seen as a system of knowledge rather than an inventory of objects." Other scholars have shared this view, emphasizing the cognitive aspect of Athapaskan technology while remarking on its apparent lack of physical objects (*e.g.*, Dumond 1980; McClellan and Denniston 1981; Nelson 1983; VanStone 1974).

Dumond (1980) commented on the sparse nature of archaeological sites associated with Athapaskan peoples, especially in comparison to Eskimo sites. Whereas Eskimo technology was oriented towards marine subsistence and

characterized by "a plethora of specialized tools," Athapaskan subsistence technology was less specialized and made use of "effective but less immediately spectacular properties such as snaring and trapping" (1980:38). McClellan and Denniston (1981:377) have also made note of the materially light subsistence technology of Athapaskan peoples stating "Cordilleran [Athapaskan] technology was admirably adopted to mobility" and that "people carried little with them, since many things could be made rather quickly with materials close at hand." According to them (1981:377), "bone, antler, horn, skin, sinew, wood, bark, and roots" (all organic) were the more important raw materials used. Of lesser importances were "stone, teeth, earth ochers" and "raw copper in the few places that it was available."

As McClellan and Denniston (1981) noted, the Athapaskan technology emphasized the use of readily available organics, *i.e.*, materials unlikely to survive and be recovered from archaeological contexts, especially in acidic boreal forest soils (Ives 1990). The result of such technology is the typically sparse Athapaskan archaeological record mentioned by Dumond (1980) above. Another factor in the relatively low archaeological visibility of Athapaskans may be attributed to the ideological aspect of subsistence technology. Boraas and Kalifornsky (1991) discussed the lack of artifacts recovered from semi-subterranean Dena'ina Athapaskan houses as a result of cultural ideas about the respectful treatment of animals. McClellan and Denniston (1981) and Ridington (1988) have discussed this ideological aspect of Athapaskan technology as inseparable from the more obviously technical aspects of subsistence. Boraas and Kalifornsky (1991) noted that according to Dena'ina tradition the bones of animals must be treated in specific ways, *i.e.*, burned or deposited in a body of water. This was done in order to ensure continued replenishment of animals and success in hunting them. The potential result of such practices on the formation of Athapaskan archaeological sites is significant and was noted by Janes (1983) in his ethnoarchaeological study of Mackenzie Basin Dene, a northern Athapaskan group.

Nelson (1983:18) characterized Athapaskan technology as "integrated with the natural world," noting that "many implements look deceptively simple, masking remarkable effectiveness. Their complexity lies in the degree to which they have

been refined and in the knowledge required to use them successfully." Ridington (1988:107) echoed this sentiment, noting that although subarctic hunting people (*e.g.*, Athapaskans) were capable of "elaborate implements such as bows and arrows, traps, and deadfalls" they were more dependent on "knowledge and technique" for successful interaction and adaptation to their environment than an investment in a complicated material culture. Ridington (1988:107 [emphasis in original]) elaborated on this point stressing that "…physical *artifacts* required…are minimal, success depends on a complex and sophisticated form of *artifice* and understanding."

The successful application of the material aspects of Athapaskan technology required extensive and intimate knowledge of the environment and the behavior of animals (McClellan and Denniston 1981; Ridington 1988; VanStone 1974). The importance of environmental knowledge in Athapaskan technology is evidenced in the use of place names (Kari 1989, 1996). Kari (1996:445) noted that Athapaskan place names "tend to be transparent in meaning, logical, and naturalistic." Productive localities on the landscape are named for the resources procured there. Kari (1996:464) suggested that "there are systematic features of Athabaskan geography that convey a sense of the symbolic organization of the Athabaskan landscape" and "place names appear in networks and constitute cognitive maps."

Another characteristic of northern Athapaskan technology is the ease with which it has incorporated features from the technology of neighboring groups, especially that of Eskimo-speaking peoples (Nelson 1974, VanStone 1974). VanStone (1974:125) notes that "Indians [Athapaskans] moving into different environments in most cases readily borrowed techniques and technologies from the people already present..." (see also Osgood 1958 and Oswalt 1967 on the Ingalik; Osgood 1937 and VanStone and Townsend 1970 on the Dena'ina).

Nelson (1974:48) commented on the apparent one-way diffusion of "technological, ideological and linguistic elements" from Eskimo-speaking peoples to northern Athapaskans. However, Kari (1989) found this not to be the case with regard to the place names used by Athapaskans in relatively new environments (*e.g.*,

Dena'ina, Navajo, and Apache) and noted that Sapir (1921) indicated that Athapaskans were resistant to linguistic borrowing.

Technological Choice

Given the above characterization of Athapaskan technology as materially frugal, uncomplicated, and adapted to mobility, metallurgy might seem out of place. An examination of the native copper technology of Athapaskans in south-central Alaska and the southwestern Yukon Territory using an anthropology of technology framework provides greater insight into this phenomenon. As presented in Chapter 2, Sillar and Tite (2000) defined five areas within a given technology where choice is exercised. There are three aspects to the following discussion of the use of native copper in south-central Alaska and southwestern Yukon.

First is the choice of raw material, why was native copper used? Why was native copper used to manufacture a variety of objects (tools and objects associated with prestige) and why was it initially used, *i.e.*, what is the origin of metallurgy in the region? The second focus incorporates the other four areas of choice identified by Sillar and Tite (2000:4): the tools, energy sources, and techniques used to work native copper and "the sequence (or *chaîne operatoire*) in which these acts are linked together to transform raw materials into consumable products." These last four areas of choice correspond to the five components of technique identified by Lemonnier (1992): matter, energy, objects, gestures, and specific knowledge. Thirdly, the context of the use of native copper as elicited by the approach of Sillar and Tite (2000:5), whereby choice is directly affected by the "situational context" and indirectly "via the context of production, the distribution, and the use," will be used to assess the value of native copper.

Raw Material

As demonstrated in Chapter 3, native copper is widely available in south-central Alaska and the southwestern Yukon Territory. As detailed in Chapters 4 and 5, the use of native copper occurred almost entirely within this cupriferous zone or in relatively nearby communities, *i.e.*, Tanana/TNX-004, Yakutat/YAK-007,

connected to groups with direct access to native copper via trade and exchange (including marriage). To point out that the availability of native copper would affect its choice as a raw material may be stating the obvious. Nevertheless, this quickly leads to the question of when groups in this region began using native copper, and why? The issue of the origin of native copper metallurgy in the region will be addressed later in this chapter.

Tools, Energy, Techniques and *Chaîne Opératoire*

Procurement

Moffit and Maddren (1908:168) state that native copper in Glacier Creek "was known to the Indians who broke out fragments from the bed rock." Despite this comment, native copper appears to have been mostly acquired from stream gravels using simple digging tools (*e.g.*, Brooks 1900; Sabina 1973; Schwatka 1996 as well as Moffit and Maddren 1908). There is some indication that though anyone could collect native copper this activity was also a way to gain notoriety (Shinkwin 1979) and though the details are unknown, this activity also required consideration of religious or supernatural factors (de Laguna and McClellan 1981).

Manufacturing Techniques

The accounts of indigenous working of native copper in Alaska and the Yukon obtained from historic, ethnohistoric, and ethnographic accounts described both cold-working and annealing. The hammering of native copper using lithics has been noted for the following Athapaskan groups: Tutchone (McClellan 1975), Dena'ina (Kari and Fall 2003; Osgood 1937), Upper Tanana (McKennan 1959), Upper Tanana/Ahtna/Nabesnatana (Raineya 1939). McClellan (1975, 1987) was also told of the practice of heat treating native copper (annealing) among the Tutchone.

Annealing

Native copper was worked by hammering nuggets into thin sheets. The hammering of native copper flattens the grain structure, which can eventually lead to stress cracks. As discussed in Chapter 6, annealing refers to the process of

heating native copper. This causes the individual copper grains to recrystallize, restoring malleability. The melting point of copper is 1084° C but annealing can be achieved with temperatures as low as 200°C though analyses of artifacts indicate that higher temperatures were often attained (700°-800°C).

Because the continued cold-hammering of native copper will eventually make the material brittle and prone to cracking, annealing was often practiced when native copper was utilized. Schroeder and Ruhl (1968) found that annealing native copper for 15 minutes at a temperature of less than 500°C was sufficient for complete recrystallization to take place. According to Vernon (1990) a temperature of 200° to 225° C will reverse the effects of cold-working and restore malleability.

In their examination of copper artifacts from the Old Copper Culture, Late Archaic, Early and Middle Woodland, Hopewell, and Mississippian periods, Schroeder and Ruhl (1968:168) found that annealed microstructures "with and without final cold-work" were typical, indicating that this was "a common procedure for forming objects from native copper until the final shape was very nearly obtained." Schroeder and Ruhl (1968:162) also noted a lack of "local etching differences due to segregation" indicating an annealing temperature of more than 600° C. A temperature of 700° to 800° C, much hotter than necessary to anneal, was determined based on the size of recrystallized grains (Schroeder and Ruhl 1968:168).

Annealing was commonly practiced when native copper was used but may not be absolutely necessary in order to create an object. Smith (1965) performed a cold-working experiment on native copper and found that the thickness of native copper could be reduced by 96% by cold-working alone, without annealing. Another way to prevent cracking would be to hot-work native copper, that is, hammer it while hot. In their experiment working native copper Clark and Purdy (1982:47) found it nearly impossible to distinguish between these two processes microstructurally. Hot working native copper would have been more difficult than periodic cold-working and annealing as it would be necessary to find a way to handle hot metal while it was being hammered. Clark and Purdy (1982) found that

after 15 minutes of cold hammering, *i.e.*, without annealing, native copper became too hot to handle.

Arctic and Subarctic Native Copper Working

In their investigation of Athapaskan and Eskimo native copper working in the Arctic and Subarctic, Franklin *et al.* (1981b:359) found that there was a "single technological pattern, characterized by folding and annealing" that "persisted through time and cross-cut traditionally recognized cultural linguistic boundaries." Hammering and folding, and to lesser extent cutting and surface grinding are considered *primary* means of working. Artifacts were formed by the hammering of native copper into thin sheets and building up of bulk by folding these sheets (Franklin *et al.* 1981a, 1981b;Workman 1976). *Secondary* working includes the existence and extent of modifications such as polishing, grooving, perforating, and riveting (Franklin *et al.* 1981b). These secondary techniques are not considered by Franklin *et al.* (1981) to be crucial with respect to cultural variation in native copper technology. However, Leader (1988), places more emphasis on such differences suggesting that the frequency with which these methods are used denote cultural technological variation. Hickey (1984) disagrees with the findings of Franklin *et al.* (1981b) for technological uniformity. He cites cold-working as major technique used by Copper Inuit and notes that Franklin *et al.* (1981a) only looked at 6 artifacts from the Copper Inuit and all are from sites occupied during the post-1850 period.

Workman (1976) provided a basic description of the sequence of steps (*chaîne operatoire*) used to manufacture native copper tools from GUL-077 based on macroscopic examination. The process starts with the flattening of nuggets of native copper into thin sheets through hammering, which are then folded and reconsolidated by repeated hammering and cutting to achieve the desired form. Seventy stone wedges were recovered from the site leading Workman to suggest that they may have been used to cut native copper. Grinding is also mentioned as being used to sharpen points and thin edges. Additionally, native copper by-products and "unfinished implements" are often found in association with cemented ash from hearths suggesting to Workman (1976) that heat treatment (annealing) was part of the technology of native copper working. As Franklin *et al.* (1981a), in their

analysis of artifacts from GUL-077, the eight artifacts analyzed in this study (Chapter 6) all showed evidence of having been annealed. The reference to Wolverine's wife starting a fire within the context of making a copper knife (Chapter 4, Upper Tanana), may be an indication of the practice of annealing.

Franklin *et al.* (1981b) noted that unlike the technology associated with other materials used by indigenous people such stone, bone, and wood, that used for native copper is not a reductive technology. Native copper was shaped by plastic deformation rather than removing pieces of the original raw material. In fact, considering that at least some native copper objects were made by building up objects through the consolidation of multiple sheets, it could be considered an additive technology.

Craft Specialization

In his 1971 article, "The Archaeological Interpretation of Prehistoric Metalworking," Rowlands examined ethnographic data to evaluate assumptions made about European metalworking. These assumptions generally asserted that metalworking was a highly specialized activity. Childe (1936, 1954) believed that the rise of metallurgy undermined pre-existing kin networks by creating a separate class of individuals who operated outside of kin obligations. He envisioned itinerant metalworkers traveling throughout Europe practicing their craft in various communities as an outsider. Though the long-distance trade of metals in Europe was believed to involve specialists such as miners, smelters, and smiths, ethnographic evidence from Africa demonstrated that consumers of metal goods often played an active role. Rowlands (1971) found that in some cases the "customers" of metalworkers had to supply their own raw material, fuel, or labor.

Rowlands (1971) also found that demand for metal objects varied seasonally with the result that periods of manufacture were also seasonal. This is an important point as the term "specialist" has implied for some a full-time occupation. Such an individual would be dependent on the rest of the community for food as they would not have time themselves to hunt, gather, or farm. Societies with a subsistence economy (*i.e.*, without agriculture or the resultant surplus) have been assumed to

lack skilled specialists because of the lack of the economic/food surplus thought necessary for a community to support individuals who do not produce their own food. Rowlands (1971:212) noted:

> The deterministic argument that an 'economic surplus' is essential for social stratification to develop is a view that has been contradicted on more than one occasion by ethnographic data showing the presence of group or individual specialists operating within the framework of a subsistence economy.

Examples from Africa demonstrate that due to the seasonality of metalworking, metalworkers, even among agriculturalists still produce their own food. Examples of "full-time specialist smiths are only consistently found when supported by privileged minorities" (Rowlands 1971:212). Furthermore, the social status of the smith cannot always be assumed to be high as they may be either highly esteemed or reviled. Contrary to Childe's (1936, 1954) notion of independent itinerate metalworkers, metalworking in Africa is seen to be a "kinship or descent group-organized activity" (Rowlands 1971:217).

Archaeological evidence indicates that copperworking was a significant activity at both GUL-077 and VAL-065. But is there evidence of the presence of individual copper working specialists among the Ahtna (or perhaps group [sib] specialization?). Evans (1978:115) listed six "expectations" for archaeological evidence for the clear presence of craft specialization. They included evidence of: (1) "workshops…specialized areas," (2) "tool kits…specialized tools," (3) "storage facilities or hoards," (4) "regular exploitation of particular resources," (5) "distribution of resources or craft products," and (6) "differential distribution."

Using these criteria, Leader (1988) compared the native copper metallurgy of the Archaic (3000-1000 BC), Middle Woodland (200 BC- AD 400), and Mississippian (AD 900-European contact) cultures to determine whether metalworking specialists were present. Evans' (1978) criteria do not address the difference between full or part-time specialists, nevertheless, Leader (1988) determined that though evidence supported the presence of metalworking specialists in the Mississippian and Middle Woodland Periods, the case for specialists during

the Archaic period was less clear. Leader cautions that there may have been metalworking specialists during the Archaic period but Evans' (1978:170) criteria are "designed to identify unambiguous specialization."

Budd and Taylor (1995) suggested that metallurgy was a function of chiefs during the Bronze Age of Eurasia, arguing for a close association between it and political power. According to Budd and Taylor (1995:139), "complex procedures are necessarily ritualized" amongst non-literate peoples, which could lead to the combination of early metal production and working with religious and political power, something that de Laguna and McClellan (1981) allude to for the Ahtna. However, ritual activity associated with the collecting and working of native copper may not be visible in the archaeological record. Another important aspect to consider is that what was thought to be a ritual part of the process of working copper may not be discernible from those processes deemed to be technically necessary (*e.g.*, heat treatment).

Wason (1994:107) remarked that craft specialization "has been widely associated with inequality," but the question of why this relationship exists "is still a matter of debate." Clark and Parry's (1990) cross-cultural study examining the relationship between craft specialization and social complexity found the association to be a reliable one predicated on the link between labor (craft specialization) and politics (control of resources). This topic will be discussed further in the following chapter.

As noted in Chapter 1 and Chapter 4, the Ahtna were known for their skill in metalworking (Von Wrangell in VanStone 1970 and Grinev 1993). According to Reckord (1983), copperworking was a specialized activity of a few males living near the Chitina River and she credited the stratification of Ahtna society with facilitating this specialization. It has been suggested by de Laguna and McClellan (1981:645) that copperworking was a specialized activity among the Ahtna as well. The Dena'ina also recognized some individuals as having become especially adept at working this material (Kari and Fall 2003). Both the Ahtna and Dena'ina have specific terms for individuals who worked copper: the Ahtna term is *c'etseden*, "one who hammers" (Kari 1990) and the Dena'ina term is *nuk'qetset*, "they pound it"

(Kari and Fall 2003). Among the Chilkat Tlingit, copperworking knowledge was supposedly kept secret (Holmberg 1985; McClellan 1975).

Some of Evans' (1978) archaeological criteria for specialization are indicated for south-central Alaska. GUL-077 and VAL-065 both have manufacturing debris related to working native copper. The restriction of this material and native copper in general to house #2 at VAL-065 does not mean this location was necessarily a workshop because the material was found within the remains of a house. The site of GUL-077 is a place where a great deal of copperworking took place but it is not possible to separate this activity from other activities at the site. It does not seem to be the case that specialized tools were used to work the copper though the techniques themselves were somewhat specialized. No caches of native copper artifacts are known from the region. The Late Prehistoric use of native copper does indicate regular exploitation of this resource but perhaps this is more the result of group (or cultural) specialization than the specialization of individuals. The comparison of native copper artifacts from YAK-007 on the coast with material from VAL-065 and GUL-077 does support the idea of differential distribution when one takes into account the number of items of personal adornment at YAK-007.

It seems unlikely that there would be enough demand for copper to keep even those individuals recognized as skilled copper workers busy year round. Such individuals would most likely have participated in subsistence and other community activities. Ethnohistoric sources indicate that potentially anyone could collect native copper and make a tool, but some individuals were known for collecting native copper as well as their skill in working it. Perhaps chiefs specialized in the trade of native copper, if not its manufacture.

Archaeology, Ethnohistory and the Value of Metals

The value of native copper will be examined in detail in the following chapter as it relates to social complexity. For the current discussion, the value of native copper to indigenous groups in Alaska and the Yukon Territory, both as raw material for tools and as a prestige technology, will be examined using archaeology,

ethnohistory, and archaeometry. An understanding of the value of native copper to Native peoples is important in examining the context of this technology.

In her review of the archaeological study of native copper artifacts in North America, Childs (1994) noted that objects in the Great Lakes region not obviously decorative were assumed to be utilitarian. This view was supported by the form and size of objects as well as the fact that native copper was readily available locally. It was reasoned that the further from the source of copper, the more likely it was to be used for non-utilitarain (*i.e.*, social, symbolic) purposes, as noted by Leader (1988). This also seems to be the case in south-central Alaska though the number of sites and artifacts available for comparison is relatively small. Binford's (1962) seminal article "Archaeology as Anthropology," focused on the changing utilization of copper among prehistoric societies of eastern North America to demonstrate how material culture can be used to address the existence and communication of status. Based on the distribution and context of artifact types found in the Great Lakes region, Binford argued that copper was initially a *sociotechnic* item, referring to "material elements having their primary functional context in the social subsystems of the total cultural system" (1962:24), and was used to signify achieved status in an egalitarian society.

Though Binford's (1962) analysis offered a new perspective on the interpretation of native copper artifacts, his view also came into question. In an article much less cited than Binford's, McHugh (1973) noted that it was never clear as to which artifacts Binford was referring to and that contrary to Binford's assertion, most finds of native copper artifacts are not from burials, a key component of Binford's analysis. Due to the appearance of wear and use on many copper artifacts, McHugh (1973) found no reason to assume that the utilitarian forms of native copper (tools and weapons) are not actually, *technomic*, Binford's (1962) term for objects used for coping with the physical environment. Additionally, Leader (1988) finds no evidence in the core area of copper sources around the upper Great Lakes for copper being used substantially differently than any other desirable lithic material, though it does seem to take on special significance with increasing distance from the source areas.

The debate over whether native copper artifacts of the Old Copper Culture had utilitarian or social value has more recently focused on metallographic analysis, specifically, the identification of annealing. Vernon (1990) finds support for Binford's conclusions. He analyzed 35 artifacts (projectile points, knives, and celts) and found that the majority were left in an annealed state at a ratio of "nearly 4:1" (1990:510). He stresses that artifacts meant to operate in the social or symbolic realm would not have required work-hardening. Such a statement should be regarded as a hypothesis for testing. Vernon (1990:510) goes on to admit, "the possibility that some annealed artifacts simply are unfinished items is another factor that should be considered." To identify annealing and interpret that as support for non-utilitarian use requires making many assumptions about both the manufacture and use of these objects. Leader (1988) conducted experiments that verified the functional ability of annealed tools by making projectile points out of native copper and testing their ability to puncture. He found that annealed tools would potentially last longer as they would bend instead of breaking upon impact, as non-annealed projectile points did. Annealed tools could be reworked and reused making them last longer and therefore more useful. As Leader (1988:57) points out, "metal hardness is only desirable when it is perceived by the user to be desirable."

There is a further problem, that of an "either/or" proposition for the use of native copper artifacts. As Levy (1993) has suggested for the use of native copper in Chalcolithic Palestine, objects may have had high social value even though they are easily recognized tool forms. A recent critique of the treatment of native copper by archaeologists in North America (Trevelyan 2003) stresses that by focusing on the economic and functional aspects of copper, archaeologists have largely ignored the symbolic aspects; *i.e.*, what Native people thought was important about copper. It has been suggested that for northeastern North America, the use of native copper for personal adornment was related to the marking of group affiliation, not for signaling wealth or status (Heckenberger, *et al.* 1990a; Heckenberger *et al.* 1990b). Despite the appropriateness of Binford's initial working assumptions about the use of copper, his early processual argument highlighted copper as a multifaceted material having functional, social, and symbolic utility. As noted above, the identification of

annealing as a process in the manufacture of native copper artifacts has come to be an important part of their interpretation.

There are conflicting views concerning how useful tools of native copper (or metal in general) were to people in the past. Renfrew (1978) and Halsey (1996) have both expressed doubts as to the usefulness of metal tools. Halsey (1996:22) believes that they "offered no real practical advantage over tools of flint, slate, and granite." Renfrew (1978:202) also asserts that they were "less durable than their counterparts of stone." However, Leader's (1988) research demonstrated that annealed native copper projectile points could potentially be repaired and re-used almost indefinitely because unlike stone and antler points, native copper points would be much more likely to bend rather than break. Such re-use could have been one of the great benefits of native copper technology. The ability to reuse a tool over and over means a great reduction in the time and energy necessary to acquire raw material (Castro, *et al.* 1998 in Chapman 2003). Another aspect of Binford's (1962) analysis questioned the usefulness of native copper artifacts. Referring to White's (1959) concept of cultural evolution where more efficient tools replace those that are less efficient, he noted that the use of native copper for utilitarian forms declined over time. He emphasized that native copper technology required greater effort than the use of other raw materials and that other materials such as stone or bone were superior to native copper for some purposes (Binford 1962).

Stories about the origin of native copper metallurgy, and Coppers, on the Northwest Coast are explicit with respect to the high value accorded to both the material and the object (*e.g.*, Boas 2002; Swanton 1909). Similarly, stories concerning the discovery of native copper among the Ahtna (de Laguna 1972) and Dena'ina (Osgood 1937) attest to its association with luck, wealth, and by extension, prestige. This association of native copper with luck, wealth, and prestige is also found in stories about its use among the Ahtna (Record 1983) and Dena'ina (Kari and Fall 2003). Additionally, the association of native copper with a powerful animal such as the wolverine (McKennan 1959) and its use as a weapon against bears (de Laguna and McClellan 1981) and humans (McClellan 1975) implicate

native copper as not only the raw material for an effective weapon but a spiritually powerful one as well.

Prestige Versus Practical Technology

In Chapter 2 an explanation was given of Hayden's (1998) concept of *prestige* technology and his approach to the study of technology using the dichotomy of *practical* versus *prestige* technology. Based on an anthropology of technology approach to the use of native copper in south-central Alaska and southwestern Yukon Territory, does this use of native copper more closely resemble *practical* or *prestige* technology?

In discussing the gold artifacts from the Balkan Chalcolithic cemetery at Varna on the Bulgarian Black Sea coast, Renfrew (1986) points out that though they may have been valued for their association with specific individuals, the fact that many of these artifacts were made of gold is significant. Gold is often found to have prime value in a number of cultural contexts, as does silver, copper, shell, jade, and various refractive stones. Renfrew notes that these materials are rare, durable, and somehow satisfying to view. Like Renfrew, Hayden discusses the qualities of prestige goods as having wide appeal and uses the phrase "pan-human aesthetic responses" in describing their effect. He points out the use of "shiny or bright" (Hayden 1998:13) materials such as metals, shells, and certain minerals for prestige goods. Because prestige goods are to be shown in community contexts, they must have striking visual qualities. Other researchers have stressed the importance of the color and luminosity of metal (Jones 2002; Jones and MacGregor, 2002; Keates, 2002; Saunders, 2002). It can be argued that part of the value of metal, and more specifically copper, is a result of its durability, rarity, and visual appeal. The question of how an object or material acquires value within a society, however, is still open.

An examination of the evidence for the use of native copper technology in south-central Alaska and southwestern Yukon Territory indicates that it is both "efficient and effective" (Hayden 1998: 2) and fulfills the six constraints listed by Hayden (1998:5, Figure 1) for analyzing *practical* technology: *task constraints*

(suitability and effectiveness of a particular technology), *locational constraints* (environmental factors that may constrain choice), *material constraints* (things such as the availability and cost of procurement of material and performance characteristics such as wear), *technological constraints* (the availability of technology and skill necessary to make use of a particular technology), *socioeconomic constraints* (issues such as mobility and ability to transport a particular technology as well as storage). *Ideological constraints* are listed in Hayden (1998:5 Figure 1) but not discussed. According to ethnohistoric, archaeological, and archaeometric data native copper technology fulfills all of the criteria for practical technology. Yet in some contexts native copper can also be seen as a prestige technology and this will be addressed in the following chapter.

Language and Landscape

The Ahtna and Dena'ina term for copper, *tsedi*, *i.e.*, "that which is hammered" emphasizes how it was worked as a raw material. Other northern Athapaskans used the term *tsetsaan*, meaning "rock excrement." Though the term for native copper amongst the Ahtna and Dena'ina is directly related to how the material was worked, other researchers have noted that indigenous terms for copper are often related to color. Herbert (1984) and Trevelyan (2003) both discuss the symbolic importance of red copper amongst Africans and Native North Americans respectively, noting that the word for copper is often associated with the word for the color red, an indication of the significance of this particular attribute.

Athapaskans living east of the Alaska-Yukon region, *i.e.*, central Canadian Subarctic, an area with native copper, have copper terms related to color. The name that the Yellowknife people (speakers of the Chipewyan dialect of Athapaskan) of the Northwest Territories, known variously as Copper Indians, Coppermine Indians, Coppermine River Indians, Red-knife Indians, use to refer to themselves translates as "yellow knife" or "copper people." The root term for copper means "pond scum" and is thought to derive from the green color that native copper can take when oxidized. The name Cree speakers used to refer to the Yellowknife people meant "red metal" or "red knife" (Gillespie 1981). The term used by for copper among the

Beaver Athapaskans was *tca tcō ne*, which means literally "beaver dung" (Goddard 1917).

While discussing the availability of native copper in Chititu Creek within WRST-NP/P, Rapp (2002:152) stated "An almost unlimited copper supply would have been available to the indigenous peoples if they had recognized the native copper in the gravels." This is a curious statement because as noted in Chapter 4, Chititu comes from the Ahtna term *Tsedi Tu'*, meaning "copper water" (Kari 1990). The antiquity of this place name certainly predates the actual mapping of the region that began in earnest in the late 19th century. Furthermore, as the number of regional copper place names mentioned in Chapter 4 make clear, as well as archaeological and ethnohistoric data, indigenous people were well aware of the presence of native copper and that it was an important resource.

This thesis does not attempt a landscape archaeology approach, however, the concept of landscape is especially relevant to the study of native copper within the context of Athapaskan technology. As Anscheutz *et al.* (2001) emphasize in their review of the use of the concept of landscape in archaeology, landscape is not the same as environment. Though landscapes are inextricably tied to a group's perception of their environment, landscapes are dynamic cultural constructions. As mentioned above, Athapaskan environmental knowledge is a key component of Athapaskan technology. The naming of features (mountains, rivers, etc.) for resources, such as native copper, creates a cognitive map (Kari 1989, 1996). The perception of the environment as providing specific resources at specific localities is the foundation of the culturally constructed Athapaskan landscape.

Origin and Adoption of Metallurgy

Before addressing the origin of Ahtna native copper technology, it will be beneficial to review ideas about the origin of metallurgy. Discussions of the invention and diffusion of metallurgy have traditionally focused on smelting technology and have been dominated by scholars who, while possessing knowledge of the technical details of smelting, are lacking in social science theory (*e.g.*, Muhly 1988; Wertime 1973). The use of native copper does not require smelting or

melting. Smelting involves heated chemical reactions whereby an ore, which is in chemically combined form (*e.g.*, as oxides or sulphides) of variable purity, is reduced to metallic form, and the metal separated from the non-metallic components that are removed as slag. For copper, which melts at 1084° C, specialized technology such as a draught furnace was needed to smelt copper ores (Tylecote 1992). Thus the adoption of smelting technology represents a significant change from the working of native metals.

The origin of metallurgy has been portrayed as a great technical leap forward and touted as one of the hallmarks of civilization. But the working of native metals, thought by some to be a stage leading to the development of more advanced metallurgy, *i.e.*, smelting, (Forbes 1964) has its roots in lithic technology. Prior to the use of native metals, there is a long history of the use of minerals for pigments (Hauptmann 1989; Hauptmann *et al.* 1992) and the use of heat to harden wood and enhance the flaking characteristics of lithics (Kenoyer and Miller 1999; Pavlish and Sheppard 1983). The unilinear approach to metallurgy discussed in Chapter 2 recognized the following steps in the development of advanced metallurgy: the hammering and annealing of native copper, melting of native copper, crucible smelting of very pure ores, smelting of impure oxide and sulphide ores, and alloying of various metals. Yet when the intermediate stages between the sole use of lithics for tools and fully developed metallurgy are examined, the use of native metals represents more of an innovation than an invention (Table 7.1)

Doubts as to whether metallurgy could have been invented more than once have persisted, though within the context of discussions of Old World metallurgy, New World metallurgy is conveniently side-stepped (*e.g.*, Muhly 1988). The working of native metals is not a huge leap for a lithic-using people, which most people in the past were. The recognition of the benefit of temporarily heating the copper is also well within the realm of what one could expect people to discover multiple times in different places.

The idea that metallurgy, and other traits, diffused from the Near East to Europe was long held to be a fact. This was certainly the view of V. Gordon Childe (1936, 1942), who unlike most of his contemporaries, had much to say about the

social aspects of metallurgy and how metallurgy may have affected social organization. Radiocarbon dating, when calibrations where applied, exposed the fallacy of assuming that all cultural traits associated with civilization had diffused from the Near East to the rest of the world. Early in this period of re-thinking European history, Colin Renfrew (1969, 1970) became an advocate for the idea of independent invention of metallurgy (smelting) in the Balkans and the Iberian Peninsula, and possibility Italy. This idea has since been supported not only by dating, which places metallurgy at the 4th millennium BC in Italy (Maggi and Pearce 2005), the 5th millennium BC in the Balkans (Jovanovic 1979; Jovanovic and Ottaway 1976), and the 5th millennium BC for Iberia (Ruiz-Toboada and Montero-Ruiz 1999), but also by the metallurgy practiced. As Killick (2001) noted, early metallurgy in Europe is represented by a variety of processes, that have in common the smelting of relatively pure copper ores in crucibles. These processes are inefficient but produce little if any slag. This type of smelting was no longer practiced in the Near East by the 4th-3rd millenniums BC, when East-West diffusion is thought to have taken place.

There is evidence that copper ores were being smelted in Turkey as early as the 7th millennium BC (Stech 1999; Tylecote 1992) and by the 4th millennium BC in Palestine (Hauptmann 1989; *et al.* 1992). By the time smelting in open crucibles appears in Europe, more efficient smelting practices were in operation in the Near East allowing for the exploitation of a variety of ore types. It has also been suggested that metallurgical developments in South Asia (Harappan Culture) (Kenoyer and Miller 1999), Southeast Asia (White 1988), and China (Franklin 1983) were less dependent on outside influence than traditionally thought.

One result of a unilinear evolutionary approach to metallurgy is that when examples of metallurgy that are not advanced (*i.e.*, do not involve smelting and alloying) are mentioned they are discussed in terms of technological deficiency. Thus, in reference to the lack of advanced metallurgy in North America, Clark and Purdy (1982:45) stated, "one explanation for this lack of evolution in metallurgy…was their abundant and accessible supply of native copper that precluded the need for melting and smelting, and actually stimulated the use of

hammering and annealing." Discussions of North American native copper metallurgy that take an evolutionary approach emphasizing what is lacking are common. Schroeder and Ruhl (1968:162) write that "the development of metallurgical techniques is usually supposed to follow a progression of hammering, annealing, melting the native metal, smelting ores, casting, and alloying" and express interest in the fact that this model did not play out in North America. As Childs (1994) has noted, early studies of metal artifacts in North America characterized the technology as "primitive" and this has had a lasting effect on how North American metallurgy has been viewed.

Some early studies of the use of native copper were stimulated by the widespread acceptance of the idea that metal artifacts from earthen mounds in North America could not have been made by the ancestors of contemporary Natives. These artifacts were credited to the hypothesized Mound-Builders or to Europeans. Cushing (1894) and Willoughby (1903) both demonstrated that metal artifacts recovered from earthen mounds could be made with a lithic tool-kit and were well within the capabilities of present-day Native North Americans. With regard to the hammering and annealing of native copper, Halsey (1996) has emphasized that these processes are no more complex than other technologies such as the working of hides and fabrication of clothing. The purpose of this discussion is not to downplay the technical capabilities of indigenous North American metallurgists or to deny them metallurgy, but rather, to demonstrate that what has been considered the first "stage" of metallurgy, *i.e.*, use of native metals, was well within the technological capability of people using a lithic technology.

Both Stech (1990) and Heskel (1983) have emphasized that the earliest metal objects (native copper) from Çatal Hüyük are found in a society that exhibited sophisticated and complex traits. According to Stech (1990:59), "early metalworking in Anatolia may be viewed as a phenomenon which existed in special circumstances, in sites where rich local resources provided the basis for the development and expression of needs which were fulfilled through communal organization of space and of symbolic representation." Heskel (1983:362) states that "the earliest metal objects in the Middle East appear in the context of permanently

settled villages, increased reliance on domesticated plants and animals, and reciprocal, nonformal exchange." These views on the context of early metallurgy are embedded in a unilinear approach to technology that equates specific technologies with levels of civilization or social complexity. The origin of the use of metals in the Arctic and Subarctic, and indeed the rest of North America, occurred among mobile hunter gatherers (*i.e.*, not sedentary agriculturalists). In their study of Indus Valley prehistoric metallurgy, Kenoyer and Miller (1999:135) caution that:

> the use and production of copper objects by groups in Rajahstan, some of which may still have been heavily dependent on hunting and/or shifting agriculture, reminds us that technological "stages" like the working of metal cannot be equated with other levels of social complexity, such as urban/non-urban.

Rosen (1984:504) approaches the question of the adoption of metal objects in the Levant by examining its effect on pre-existing lithic technology. Rosen found that after the initial introduction of metal objects, several millennia passed before metal objects became abundant. Furthermore, flint tools persisted for 1,000 years after the abundant use of metals. Rosen found that flint objects were not replaced early on in adoption of metallurgy as the "vast majority of copper objects dating to the Chalcolithic seem to reflect ceremonial and ritual functions" (Rosen 1984:504). Similarly, Basalla (1988:31-32) states that the introduction of metallurgy did not bring about significant change in the manufacture of tools. Instead, metal tools were originally based upon lithic "prototypes" and that "the weight of the tradition of stone technology exerted a long-lasting influence on the shape of these tools." Rosen (1984:504) found that those flint tools replaced most quickly by metal were axes/celts and awls and stressed that:

> the tendency to assume that the introduction of metallurgical technology was a great technological advance the reason for whose adoption is inherently obvious belies important aspects of that adoption. Other variables, including trade, specialization, and the nature of the tools being replaced, were at least as significant as the nature of the metals themselves.

Indeed, contrary to the mechanically deterministic notion that metallurgy represented a major technological advance that Rosen refers to above, Heskel (1983) points out that there is a 2,000 year absence of metallurgy in Çatal Hüyük (Anatolia) after the initial heat treatment of native copper in the late 7th and early 6th millenia BC. However, Heskel's (1983) assessment of why metallurgy ceases for 2,000 years relies on a mechanical, technologically deterministic model of the adoption of metallurgy. According to Heskel, the smelting of copper ores did not follow upon the exploitation of native copper because the necessary food surplus to support this activity was absent. As the earlier discussion of specialization demonstrated, sedentism and surplus are not required for individuals to specialize in metallurgy. As to why native copper did not continue to be used, Heskel attributes it to the decentralization of the large community of Çatal Hüyük and movement towards "smaller, more self-contained settlements" (1983:365). This simplistic explanation highlights the difficulty of discussing the context of not only the adoption but also abandonment of metallurgy in archaeological situations. The question of why the use of native copper declined in the Great Lakes region after the archaic period, initially posed by Binford (1962), still remains unanswered.

Renfrew (1978) emphasized that an explanation for the increasing use of metals is not just a technical, but also a social issue. Smith (1970, 1976, 1981) was an early proponent for emphasizing the non-technical aspects of metallurgy. Though a materials scientist, he noted that the earliest uses of pyrotechnology (ceramics and metallurgy) were decorative rather than functional (*i.e.*, tools or weapons) and proposed that the origin of pyrotechnology was mostly concerned with aesthetics.

Origin of Athapaskan Metallurgy

The question of the origin of Athapaskan (northern) working of native copper has been addressed by Clark (1991) and Franklin (*et al.* 1981a, 1982). Clark (1991:116) states, "given the similarities in metal-smithing techniques between regions, northern copperworking probably developed in one area first and then spread to others." But other researchers have noted that the primary means of working native copper are similar over not just the Arctic/Subarctic, or even North America as a whole, but wherever native copper was worked (*e.g.*, Smith 1965;

Stech 1990; Tylecote 1992). On the matter of annealing, Clark (1991:116) suggests that though hammering native copper was a simple enough technique to have been "reinvented by different peoples over and over again;" the technique of annealing must have been learned rather than developed multiple times because it is "complex" and "cannot be perceived through visual or manual examination of the product." Clark's ideas with respect to what northern indigenous peoples could or could not have accomplished on their own without the diffusion of knowledge from elsewhere is highly speculative at best and seems rather dubious. As discussed earlier, native copper was worked using an essentially lithic tool kit. Furthermore, Clark actually suggested that northern peoples may have already been aware of heat treatment techniques for improving the flakability of other lithics. He commented that the relatively late use of native copper was "circumstantial evidence" for diffusion of native copper technology. Contrary to his other statements, Clark (1991:116) stressed that "there is no evidence to suggest the copper-working in the North is related to that in the Great Lakes region" and "there may have been more than one North American origin."

Franklin *et al.* (1981b:359) offered two models to explain widespread occurrence of what they consider to be a single (and relatively uniform) technology in the Arctic and Subarctic. The first model is that all finished artifacts of native copper came from a single "locus." Whether this "locus" represents a single site or region is unclear. This model has no support from archaeology or ethnohistory and indeed it was not the model they favored. The second model was that all copper working technology originated from a single locus" and diffused from there "possibly accompanied by raw material and/or experts." Though the second model was considered by them to be a better explanation it should be pointed out that this too is based largely on speculation. They do not actually propose where native copper technology in the north originated. Franklin (1982) revised these conclusions and offered a different pair of possible models to explain the distribution of a single (unique and distinctive) native copper technology in the north. In this paper the first model was discarded with the resulting two models being either diffusion (spread of artifacts, technology, or raw material) or independent development. Once again,

diffusion is the preferred explanation but Franklin (1982:52) stressed that independent development "should not yet be discounted."

Based on archaeological evidence, the use of native copper by Athapaskan peoples in this region occurred no earlier than around AD 900 and became more common during the period from AD 1100-1400. Compared to the existence of metallurgy elsewhere in North America for as long as 7,000 years or 8,000 years, this is relatively late. There is plenty of time for the knowledge of metallurgy to have diffused to Alaska and the Yukon from elsewhere, but no conclusive evidence that this is what happened.

The Ahtna, whose territory encompasses numerous native copper sources in the region, were credited with the invention of working copper by their neighbors, including the northern Tlingit with whom they traded and intermarried (de Laguna *et al.* 1964; de Laguna 1972). The Ahtna homeland is mountainous, has many glaciers, and few archaeological sites in the vicinity of native copper, especially beyond about 2,000 years ago. The discovery of native copper approximately 1100 years ago may only just post-date the occupation and use of areas with native copper (Brooks 1900). Regional legends and myths surrounding native copper seem to credit indigenous people (Athapaskans) with its discovery (de Laguna 1972; McClellan 1987; McKennan 1959; Osgood 1937). Additionally, Moodie *et al.* (1992) point out that oral history among Athapaskans further to the east, *i.e.*, Yellowknife and Chipewyan, describe the discovery of copper as having occurred to the west in a mountainous volcanic region with rivers that run into a nearby sea. As Moodie *et al.* (1992) assert, this accurately describes south-central Alaska and the southwestern Yukon Territory

Tsedi, the term for copper among most of the Ahtna (except the Mentasta dialect), is different than that of other northern Athapaskans and does not appear to have been borrowed. In fact, the term seems to reflect its importance as a source of raw material. Within Ahtna territory there is a place name, *Tsedi Kulaende*, that is translated as "where copper exists." This is reportedly the location where the Ahtna discovered copper (Kari 2005). It is not clear whether this story is related to other oral traditions dealing with copper. Native copper is unlikely to have gone

unnoticed once people began to move around places where it was available because it is visually striking. When found it does not have a shiny metallic appearance. When exposed to the atmosphere, copper nuggets develop a layer of green and blue corrosion products (carbonates and oxides) that stand out dramatically from other lithic material and sediment matrices. As suggested earlier, people already acquainted with lithic technology (including heat treatment) do not need to be shown how to work native copper, or develop new technologies to do so.

The terms used for copper by southern Athapaskans are based on the word for knife. Thus, in Western Apache the term used is *bésh łitsogi*, "knife (or metal) the yellow/orange one" (Bray 1998), and in Navajo *béésh łichíi'ii*, "red metal" (Young and Morgan 1987). These terms, which resemble neither the Ahtna/Dena'ina term (*tsedi*) nor the term used by other northern Athapaskans (*tsetsaan'*), perhaps indicate that the southward migration of these groups, hypothesized to have occurred around 1,200 years ago (Ives 2003), took place before northern Athapaskans adopted native copper technology.

The above points are not offered as definitive proof that Ahtna native copper metallurgy is an autochthonous development, but rather to demonstrate it as a possibility and an equally valid alternative to the traditional and deeply entrenched approach of assuming diffusion rather than proposing it as a hypothesis to be tested. Indeed, as mentioned earlier, Athapaskans are known for being prodigious borrowers of technology from neighboring groups, especially Eskimo-speaking peoples. If Ahtna, and more generally, Athapaskan, metallurgy was a result of diffusion from elsewhere, what are the likely candidates and why did it occur so late?

The earliest directly dated evidence of native copper working in North America comes from a site in Minnesota, where a spear point was recovered still attached to a portion of its wooden haft. The haft was AMS radiocarbon dated to approximately 6800 BP. An even earlier date from Michigan of 7870±350 BP (uncal) (Beukens *et al.* 1992), was obtained on charcoal from a hearth that was 10 cm from a fragment of worked copper. Numerous other sites in the region with copper date to around 5000 BP. Martin (1999) dates the beginning of the use of

copper to some time between 7500-6800 BP. Relatively soon after the region was deglaciated, people moved into the area and began to make use of the abundant native copper.

The earliest evidence of metallurgy in South America is a silver-copper alloy bead from coastal Peru and dates to around 2100 BC (Bruhns 1994). There is a general temporal trend of metallurgy first appearing in the Andes and later in Central America and Mexico. This trend supports the hypothesis that metallurgy diffused from south to north (Andes to Mexico). In the Andes gold was being worked by 1800 BC and copper by 1500 BC (Bruhns 1994). Metallurgy appears in Columbia and Ecuador around 500-400 BC, Panama and Cost Rica around AD 500, and Guatemala and Belize around AD 800 (Palmer *et al.* 1998). Prior to the appearance of metallurgy in Guatemala and Belize it appears in west Mexico around AD 600, likely as a result of direct trade with coastal South America (Hosler 2002). By AD 1000, and perhaps as early as AD 900, metallurgy had diffused from Mexico into the southwestern United States and was widespread by AD 1100 (Hosler 2002; Palmer *et al.* 1998).

As the above brief review of the timing of the appearance of metallurgy in Central and South America demonstrates, metallurgy in these regions involved smelting in addition to the use of native metals. Indigenous smelting technology did not develop any further north than the southwestern United States. There is currently no evidence of a relationship between metallurgy in North American (Great Lakes region) and South America. Neither is there an obvious connection between the metallurgy of the Great Lakes and northwestern North America.

In northwestern North America there are two other regions where native copper was utilized, the Central Arctic and the Northwest Coast. Based on archaeological evidence native copper was being worked in the Central Arctic by presumably Eskimo-speaking peoples as early as 3000 years ago (McGhee 1970). Three native copper artifacts were recovered from the Pre-Dorset (Arctic Small Tool Tradition) component of the Bloody Falls site but McGhee acknowledged that this component may have been mixed with the later Thule component of the site. McGhee (1972) later described the native copper artifacts from the Bloody Falls site

as being associated with the Thule component that he dated to AD 1200-1600. Evidence for the use of native copper (and iron) in the Central Arctic is more definitive starting around AD 800 and becomes increasingly common in the period from AD 1000-1600 (McCartney 1988). Noble (1971) also reports native copper from early contexts in the Subarctic, but the details of these contexts are uncertain. There are several sources of native copper in the region (Franklin *et al.* 1981a; Rapp *et al.* 1990). As noted earlier, Athapaskans have often adopted certain technologies from Eskimo peoples. It is certainly possible that Athapaskans learned an appreciation for native copper from Eskimo groups. The timing of the appearance of native copper among Athapaskans in Alaska and the Yukon is close to the transition from the use of atlatl to bow and arrow technology believed to have occurred at around 1,250 BP (Hare *et al.* 2004).

The earliest date associated with native copper from an archaeological context on the Northwest Coast is around 2500 years ago (Ames 2005). As noted earlier, native copper from archaeological contexts on the Northwest Coast is much discussed but in reality quite rare. It is a long way from Prince Rupert Harbour to Northern Tlingit groups and the Ahtna and there is little evidence of the use of native copper in the region that lies between. Though Alaska has been suggested as a source of archaeological native copper found on the Northwest Coast, this region has sources of native copper. If one were to rank the likelihood of one of these two regions being the source of native copper technology among the Ahtna, the Central Arctic/Subarctic seems more likely due to the extent of connections between eastern and western Athapaskans and interaction between Athapaskan and Eskimo groups.

Summary

An examination of native copper metallurgy, when viewed within the context of Athapaskan technology in general coupled with Sillar and Tite's (2000) idea of technological choice, reveals two main points. First, though the ultimate origin of Athapaskan native copper metallurgy (*i.e.*, time and place) is unknown at this time, the widespread availability of native copper in southcentral Alaska and southwestern Yukon coupled with the existence of the basic technological repertoire

necessary for working native copper among Athapaskan groups preclude the necessity for an external origin. Secondly, though native copper was incorporated into the Athapaskan utilitarian toolkit and seldom used by Athapaskans for prestige goods, particularly objects of personal adornment, the raw material was accorded high value and it was associated with individual prestige. Evidence of this high value and its association with individual prestige are found in ethnohistoric accounts dealing with its procurement and the existence of craft specialists.

Table 7.1 Comparison of lithic and metallurgical technologies.

Lithic	Metallurgy
Heat treatment of lithic material to enhance workability	Hammering and annealing of native copper
Use of minerals for pigment and decoration	Melting of native copper
Hammering and annealing native copper	Crucible smelting of very pure ores
	Smelting of oxide and sulphide ores
	Alloying of various metals

Chapter 8. The Value of Metal and Social Complexity

This chapter provides a discussion that combines theoretical perspectives on the development of social complexity in northwestern North America with ideas expressed in the archaeological literature concerning the relationship between metallurgy and social complexity. The discussion focuses on the potential use of native copper not only to demonstrate, but also to create, differences in individual prestige and its potential role in the development of hereditary rank among the Ahtna Athapaskans. However, the relevance of this discussion is not limited to Ahtna ranking but has wider application within anthropology and archaeology. Metallurgy has been implicated in both the expression and development of social complexity by a number of researchers, generally in reference to middle-range societies, *i.e.* chiefdoms, and states (Binford 1962; Budd and Taylor 1995; Childe 1942; Earle 1997; Helms 1976; Knapp 1986, 1990; Leader 1988; Nakou 1995; Pollard 1987; Renfrew 1972, 1986; Shennan 1986; Sherratt 1994). Additionally, archaeologists have considered metal from archaeological contexts as a suitable vehicle for examining notions such as value, prestige and power (Pydyn 1998; Voutsaki 1997).

Social Complexity

Definition

Use of the term social complexity, and the archaeological identification of rank, both suffer from problems of definition. Chapman (2003) provides an excellent synopsis of what a poorly defined concept social complexity is among archaeologists in his review of relevant literature from the Mediterranean, especially Spain. When social complexity is defined at all, it is often described in dichotomous terms (unequal vs. equal, egalitarian vs. non-egalitarian) that fail to describe accurately not only the range of human societies but variability within a society (Chapman 2003).

Much has been written about ranking in both anthropological and archaeological literature. Much of the work of archaeologists has focused on the

identification of ranking, or social complexity more generally, in the material remains of the past (*e.g.*, Peebles and Kus 1977; Wason 1994) though attempts to explain how and why it developed have increased over the years (*e.g.*, Arnold 1996; Earle 1997). One of the major problems with identifying ranking archaeologically has been in defining 'ranking.' According to Fried (1967:109), in a ranked society "positions of valued status are somehow limited, so that not all those of sufficient talent to occupy such statuses actually achieve them." A stratified society, according to Fried (1967:186), is "one in which members of the same sex and equivalent age status do not have equal access to the basic resources that sustain life."

In addressing the issue of social inequality, Hayden (2001) also draws attention to the fact that there is a problem of definition. He finds the usage of the terms ranking, hierarchy, and stratification problematic and instead uses the term transegalitarian. According to Hayden a society where social relations are egalitarian is one where sharing is pervasive and the owning of private property is insignificant. What differences there are in social standing in an egalitarian society are a result of age, sex, personality, and perhaps birth order. Chapman (2003:76) however, stresses that inequalities do exist in societies categorized as egalitarian with the result that it is crucial "to make distinctions between egalitarian relations, societies, and ideologies, and to recognize that all societies may exhibit tensions between egalitarian and hierarchical relations." A transegalitarian society is defined by Hayden as having significant ownership of private property, minimal sharing, and a wealth-based hierarchy that has become institutionalized, though kinship is still an important factor in the establishment of hierarchy (Hayden 2001). Thus, transegalitarian societies differ from egalitarian societies mainly in the extent of sharing and the ownership of private property. The term transegalitarian acknowledges the point made by Chapman (2003) that even egalitarian societies will exhibit inequality in some contexts.

A key indicator used by archaeologists to identify socioeconomic inequality, and by extension rank, is the presence of prestige goods. As mentioned earlier, the purpose of prestige technology "is not to perform a practical task, but to display wealth, success, and power" (Hayden 1998:11). The main motivation for the

manipulation of prestige technologies and goods is the achievement of social goals. An important focus for Hayden is the notion of an *aggrandizer*, someone who attempts to acquire power in a society. An *aggrandizer* uses prestige goods not merely as a sign of wealth but to create situations of indebtedness and obligation and to support economic and subsequently political inequality (*i.e.*, power) (Hayden 1998). As Pydyn (1998) stresses prestige goods must be not only recognized by everyone in society, but also associated with a specific individual owner.

Athapaskan Social Complexity

According to Townsend (1980), several of the Native societies whose use of native copper is discussed in Chapter 4 are ranked societies, namely, the Ahtna and Dena'ian Athapaskans, Yakutat Tlingit, Chugach Eskimo, and Eyak. To this list could be added the Tutchone Athapaskans (Legros 1985) as well as other Tlingit groups (de Laguna 1990b). The following discussion will focus solely on Athapaskan groups.

According to Simeone (1995: xviii), "in Athapaskan culture, competition and cooperation exist in a dialectical relationship. Individuals compete for power and prestige in the face of a cultural ideal that stresses cooperation and solidarity." This statement neatly summarizes an observed contradiction found in some Athapaskan societies, that is, the existence of non-egalitarian behavior and institutions in what have been described as egalitarian societies. This contradiction revolves around leadership and sharing.

Fall (1987:40) noted that the Dena'ina social system was "based on ranked kinship and the culturally prescribed utilization of wealth." The Dena'ina recognized two categories of people, "commoners" who lack "wealth and prestige" and an aristocracy made up of wealthy men and their immediate relatives (Fall 1987:40). These groups are not considered classes as all members of society had access to subsistence resources (Townsend 1980).

Some leaders in Athapaskan society were able to use their position of elevated rank to accumulate wealth by controlling trade (Legros 1985; Simeone 1995). The accumulation of wealth allowed these leaders to enhance their prestige

by redistributing goods, often via potlatches (Fall 1987; McClellan 1975; McKennan 1959; Townsend 1980; Vanstone 1974). As Simeone (1995) points out this, "led to the development of a stratified society with inherited leadership" among some Athapaskans, such as the Carrier (Bishop 1987), Tutchone, and Tagish (McClellan 1975), resembling the social complexity found among coastal groups. Though the fur trade, or even aboriginal trade, allowed Athapaskan leaders to enhance their prestige through the distribution of trade goods, Athapaskan leadership was also dependent on other factors. Despite the potential for positions of leadership to be inherited among Athapaskans, it is generally characterized as being dependent upon a variety of factors such as: knowledge of how to deal with the supernatural, hunting ability, the ability to motivate and organize subsistence and trading activities, kin ties, sib affiliation, public speaking ability, and generosity (Fall 1987; McKennan 1959; Reckord 1983; VanStone 1974).

The sharing of subsistence resources, both land and food, within Athapaskan society can be characterized as pervasive (*e.g.*, Lane 1981; McKennan 1959; McClellan 1975; Reckord 1983; Savishinsky and Hara 1981) and would likely have been an obligation for someone in a position of leadership (Fall 1987). As Fall (1987) noted for the Dena'ina, prestige was dependent on accumulation *and* redistribution. The situation regarding non-food resources, however, is less clear. Restrictive ownership has been discussed for the Carrier with regards to beaver hunting territory (Bishop 1987), the Tutchone for a variety of resources including prime hunting and fishing localities and native copper (Legros 1985) and among the Ahtna for native copper (Shinkwin 1979).

The description of some Athapaskan societies (Ahtna, Tutchone, Dena'ina, Carrier) from historic, ethnohistoric, and ethnographic sources provides some contradictions with regard to social complexity and supports the use of the term transegalitarian. One qualification that should be made to Hayden's definition is the extent of sharing. Though these societies demonstrate private ownership, or at least restricted access to, some resources, the sharing of food was probably beyond minimal. Otherwise, the transegalitarian concept is of use in discussing social

complexity among some Athapaskan groups and the emphasis on, and development of, ranking and hereditary leadership.

Ahtna Ranking

Contrary to the perception of Athapaskan society as egalitarian, Ahtna society has been characterized as highly stratified (de Laguna and McClellan 1981; Reckord 1983). This is especially the case for the Lower Ahtna, who occupied the lower portion of the Copper River valley north of the Chugach Mountain range, and the area drained by the Chitina River. The Ahtna situation appears remarkable in comparison to other northern Athapaskan groups, who are generally characterized as less socially complex (*i.e.*, more egalitarian) than neighboring groups on the Northwest Coast. However, there is great variability among northern Athapaskan societies (Ives 1990; Vanstone 1974) and the emphasis on ranking among the Ahtna is not entirely unique as it has been noted for other groups such as the Dena'ina (Fall 1987; Townsend 1980), Tutchone (Legros 1985; McClellan 1975, 1981), Tagish (McClellan 1975), and the Carrier (Bishop 1987).

The stratified character of Ahtna society was attested to by early travelers to the Copper River region (Allen 1887:52; Grinev 1997:14). Among the Ahtna, leaders, known as Denae, provided economic leadership and were noted for their wealth derived from trade. They also managed the use of caribou fences and fish weirs and attracted followers because of their ability to feed them (De Laguna 1987). Reckord (1983) notes that in addition to organizing subsistence and trade Denae also organized the collection of copper. Ahtna Denae did not perform physical labor and they and their relatives were deferred to. Ranking was also expressed in seating arrangements (Allen 1900). Allen further noted (1900:435), "never have I known lines of cast to be so rigidly drawn as with these people." As with the male members of society, the status of women was dependent on their relation to Denae (Reckord 1983).

Despite the characterization of Ahtna society as highly stratified, statements regarding Ahtna leadership are conflicting. De Laguna characterized Ahtna leadership as "autocratic," but also noted that there was "no permanent aristocracy"

or "fixed succession to leadership in any clan or settlement" (1987:87). Reckord (1983:45) states there were "no genealogical rules of succession to denae-ship, and no guarantee that the brothers, sister's sons, or children of a denae would succeed him." Reckord (1983:45) additionally notes "The separation of the inheritance of political position and of belongings insured that people gained status through their own abilities, rather than through inheritance of power originally consolidated by another person."

Prestige, Value, and Metallurgy

The Value of Metals

Childe (1942:338) drew attention to the fact that metals allowed for "accumulation and convertibility." The ability of metals to be melted or otherwise manipulated to create large objects from small, allowed for the expression of different values in an accumulative manner. This allowed metal to be more easily converted into other things of value and forms of payment. As later summed up by Sherratt (1994), individuals who could control metallurgy would have power over its convertibility. Thus, the control of access to both metal ores and knowledge of metallurgy could help to maintain socioeconomic inequality and political power.

Renfrew (1972) postulated a relationship between the exchange of metals and the appearance of high status elites in Bronze Age Europe. Whether metallurgy is viewed strictly within technological terms or as the means to acquire and display wealth, the desire to control material sources and production was considered sufficient to explain the emergence of elites. Nakou (1995), however, emphasizes the importance of metal to an emerging elite was its ability to carry social information. Beginning in the Early Bronze Age "the appropriation of production and symbolic use of metal represents its active use as an element of formalized display, identifying emergent social groups of exclusive membership" (Nakou 1995:23). In discussing metallurgy during the Early Bronze Age of Europe, Shennan (1986:117), suggests that initially metallurgy served to demonstrate social differences essentially unrelated to the technology itself. Later, the control of

metallurgical technology actually created "social and economic distinctions", *i.e.*, differences in wealth and by extension prestige and power.

Knapp (1990) made an important distinction concerning the relative value of copper to different groups, *i.e.* producers versus consumers. Though discussing the mining and smelting of copper during the Bronze Age of Cyprus, his comments are relevant for discussing the emphasis on the use of native copper for prestige-related items at YAK-007. Knapp (1990:161), in noting the "disproportionate deposition of copper artifacts" at cemeteries and sites near copper sources, believed that this was a reflection of "differing attitudes towards metals." Whereas copper was a "*commodity*" to those who mined and produced it, *i.e.*, its value was dependent upon what could be obtained through exchange, for consumers of copper products, it was an object of "*wealth* and *status*" and valued for its ability to signal social differentiation (Knapp 1990:161 [emphasis in original]).

According to Nakou (1995), the control of metal production fostered differential power relationships between the makers and users of metal objects. Early Bronze Age Aegean metalworking activities, while arranged to some degree near ore sources, were often located so as to monopolize the technical knowledge of metallurgy. This physical separation of metalworking activities from communities served to maintain the importance of metal goods as something mysterious while simultaneously strengthening power relationships. Metals were valued not only for the scarcity of raw materials, but also for the scarcity of knowledge in production. This intellectual monopoly would have allowed for the creation of differential power between groups in a lineage-based society (Nakou 1995).

Pydyn (1998:97) states "value, like prestige and power, belongs to those categories which are very difficult to define but which at the same time all of us recognize." The determination of what has value is subjective, though some values may have "absolute or universal character and very often they form the basis for social communications and social relations" (1998:97).

For Marx (in Voutsaki 1997), value was closely bound to labor. An object's value was formed during production. In societies without market or monetary economies where labor cannot be bought and sold, this definition is deficient

because labor is not itself a commodity. This being the case, the concept of value as economic exchange involving cost and price has limited validity when looking at these societies. Unlike cost, value is dependent on cultural and symbolic factors (Voutsaki 1997). Building on Marx, Renfrew (1986) discusses different aspects of value. First of all, value is a property of an item that is ascribed arbitrarily by an individual or a society and is dependent on the social context. The ascribed value can be a result of the future usefulness of the object (*use value*), or the amount of effort required for its production (*labor value*). In examining prestige goods Renfrew highlights an additional kind of value. Following Appadurai, he uses the term *prime value* for "those materials that in a given culture are regarded as having intrinsic value" (*i.e.*, prestige goods) (Renfrew 1986:159). Renfrew points out that "no materials have a universal intrinsic value…prime value is thus the equivalent of ascribed intrinsic value" (Renfrew 1986:159).

The circumstances under which an object or material comes to have prime value have been addressed in anthropology within the context of gift exchange. The work of Mauss (1990) was crucial in examining the role of gift exchange in the foundation of both prestige and power. Gift exchange differs from exchange in a monetary or market economy in that it is driven by reciprocity. This reciprocal exchange of gifts takes place not within a single trading event but instead on a regular and uninterrupted basis over time. Within a system of gift exchange, access to prestige goods is limited by the coexistence of multiple ranked and exclusive categories of exchange items. Flexibility is introduced by the ability of individual participants in a transaction to be successful with the result that a prestige good is dependent on personal competency in exchange. There is no strict value of goods circulating in a system of gift exchange. Because a gift received must eventually be repaid with a gift of equal or higher value, goods have an "exchange order" (Voutsaki 1997:36).

Because direct equivalence is not a factor, as in a monetary economy, the value of an object is less restricted. The history of an object is part of what makes it valuable. It then follows that value can continue to accrue for an object long after it was produced. The value of an object is formed during the actual process of

exchange. Voutsaki (1997) points out that this value cannot be divorced from the context of the exchange of gifts. The social status of participants is what is crucial in gift exchange not just the value of the object. In this way prestige goods and elites, individuals of high rank, are created and defined in a mutual and simultaneous fashion (Voutsaki 1997). The emphasis on history and association with individuals as contributing to value has relevance for Northwest Coast Coppers (de Widerspach-Thor 1981), discussed further below.

Northwest Coast Coppers and the Conspicuous Consumption of Metal

Native copper has been associated with high status (prestige) on the Northwest Coast (Ames 2005; Ames and Maschner 1999; Blake 2004; Drucker 1943; de Laguna *et al.* 1964; Hayden and Schulting 1997; Tybjerg 1977). Though the focus of this thesis is on the use of native copper, a review of the data concerning Northwest Coast Coppers is useful for discussing both the value of copper and the relationship between copper and individual prestige. Though variable in size, Coppers were shield-like objects that could be as large as 1 x 0.6m, and were found among the Tlingit, Haida, Tsimshian, and Kwakiutl groups of the Northwest Coast (Duff 1981). Coppers were the most highly valued form of material culture and were considered to be the most desired object of exchange (de Laguna 1972; Emmons 1991; Kan 1989).

De Laguna noted that of the 135 Coppers known from museums (Emmons 1991), at least 125 of these have been subjected to metallographic examination confirming that they were made of non-native commercially produced industrial metal (Couture and Edwards 1962, 1963; Jopling 1989; Wayman *et al.* 1992). Despite the lack of examples made of native copper, the owners of these objects often referred to the Chitina and White River region as the source of the copper. When the use of trade metal was acknowledged by Natives, it was emphasized that those made of native copper were more valuable (de Laguna 1972; Emmons 1991). Such statements regarding the authenticity and relative value of Coppers may have more to do with their use and validation through exchange and display rather than their actually being made of native copper (de Widerspach-Thor 1981).

Initially, copper traded to Natives via Russian posts and vessels of various nations was in the form of kettles, pots, and smaller objects (Jopling 1989). By the mid-eighteenth century copper sheathing began to be applied to the hulls of British ships in order to prevent sea worm boring and keep them smooth to promote greater speed (Knight 1973). As a result, there was an increase in the amount of sheet copper already carried by ships for repair purposes. When fur traders arrived on the Northwest Coast in the late eighteenth century and discovered that the value accorded copper by indigenous groups was much greater than that warranted based simply on the weight of the metal, it became an important trade good. Eventually, Coppers were manufactured using sheet copper (Emmons 1991; Jopling 1989). Beginning in the 1770s sheet copper, initially from vessels involved in the maritime fur trade, flooded the Northwest Coast. Early in the nineteenth century sheet copper was available from the Russians at Sitka, and by the mid-nineteenth century was also obtained from the English at Victoria (Jopling 1989; Keithahn 1964; Mackenzie 1891; Rickard 1939). Due to the availability of large quantities of sheet copper from multiple sources, demand for it had dropped significantly as early as the 1790s (Keithahn 1964). Eventually, perhaps not until the mid or latter part of the nineteenth century, the value accorded Coppers decreased (Mackenzie 1891; Rickard 1939).

Coppers were first noted in 1787 by Colnett in the southern Queen Charlotte Islands and then in 1793 by Mackenzie in Bella Coola villages. The earliest published account of a Copper is from Lisiansky who was in Sitka, Alaska in 1804 (Emmons 1991). According to Rickard (1939), Coppers were never made of native copper and appear only after 1774 when the Northwest Coast became inundated with trade copper. While acknowledging that Coppers were largely a post-contact phenomenon, based on descriptions provided by informants in Yakutat Bay, de Laguna (1972) suggests that smaller forms actually made of native copper could have preceded them.

The value of a Copper increased every time it was displayed, given, traded, or sold, and they generally moved from north to south along the Northwest Coast. Their value increased during a potlatch in proportion to the value of goods

distributed to guests. Totemic designs, most often lineage or house crests, also contributed to their value. Indeed, although only chiefs are supposed to have owned Coppers they were considered to be lineage property (Emmons 1991). In 1804 Lisianksy gives the value of a Copper as 20-30 sea otter skins, which may have been a common way of figuring value within the context of the Russian fur trade (Emmons 1991). In the late nineteenth century a Copper was worth 10 slaves or 1000 blankets (Mackenzie in de Widerspach-Thor 1981) suggesting that some individual Coppers may have retained their value even after the region was flooded with trade copper.

There are two instances of copper (or Coppers, depending on the interpretation) being used to purchase territory. An Ahtna sib from the Chitina area (ancestors of the Kwackqwan) purchased the Humpback Salmon Stream in Yakutat Bay with either a Copper or possibly a large nugget (worth ten slaves) that required six men to carry it from the Tana River (Keithahn 1964; Swanton 1909). In another version of this transaction the stream was purchased with either sea otter furs and Coppers, or with a large canoe hung with seven Coppers on each side, each Copper worth 10 slaves (de Laguna 1972). In a separate transaction the Drum House of the Teqwedi purchased their lands at Ahrnklin River with a single copper measuring the length of the finger tips to the chin, which was worth 10 slaves (de Laguna 1972). According to information provided to Harrington by Jack Ellis and quoted by de Laguna's, "the southern Indians did not have copper...when they came to Cordova region [eastern Prince William Sound] they bought it...just a little flat piece six inches long and wide was worth a slave" (1972:354), suggesting that the high value accorded native copper pre-dates the existence of Coppers.

As discussed earlier, prestige technology frequently produces items that are destined to be destroyed through a sacrificial offering or buried during a high status funeral, both community events (Hayden 1998). It is within these contexts that aggrandizers seek to show their economic and political achievements. Hayden goes on to state that in a transegalitarian society a great deal of "social information symbolized in material culture may be prestige related" (1998:15).

Voutsaki (1997) also concentrates on the relationship between the value of metals and their use in not only demonstrating, but also creating social complexity. She approaches the socially constructed notions of "value, power and prestige" (Voutsaki 1997:34) through an examination of archaeological metal. For her, power is tied to the concept of value, specifically, what gives an object or material value and what is the relationship between the value of material things and the prestige of people. Though the value of an object may be related to the labor of production, value also accrues to an object as it moves through a gift exchange system and when it is consumed.

Consumption can take one of two forms, either destruction in ritual, or deposition during a funeral or sacrificial offering and it dramatically changes the value of an object by removing it from the system of gift exchange. Destruction and deposition fixes the value of an object and turns it into social value. Removing prestige goods from the gift exchange system may balance economic inequality but creates social inequality, *i.e.*, prestige. Consumption can be seen as a symbolic accumulation (Voutsaki 1997). Furthermore, conspicuous consumption must be viewed by the community in order to be effective. According to Pydyn (1998:100), "A value is not created by a secret accumulation of goods but by public consumption and use (or even waste in the modern sense)". He finds that in the Baltic Bronze Age the greatest value of a bronze object may have only been attained when it was symbolically destroyed during burial at a funeral or sacrifice. Conspicuous consumption is not an expression of social inequality but is instead a tactic used to create it (Voutsaki 1997).

The preceding discussion is fitting for an examination of Coppers that could be consumed in a number of ways, including: thrown into the ocean (Duff 1981), broken with the detached pieces given to the higher status guests at a potlatch, completely destroyed, or placed on a mortuary pole or grave house (Emmons 1991). Coppers were used to accrue prestige at public events in the same manner as slaves and like slaves could be freed or killed through destruction. In fact, within the context of a potlatch the gift-giving related most directly with personal prestige is

the freeing (or killing) of slaves, and one could add the destruction of Coppers (Tybjerg 1977).

Geography and Value

Distance

In Tybjerg's (1977) discussion of the Tlingit potlatch he points out that the more distant the guests, the greater the prestige conferred upon the host. Similarly, objects procured from greater distances were seen to be more prestigious than those locally obtainable (see Helms 1988 for a general discussion of the relationship between distance, knowledge, and power using ethnographic and historic sources). Emmons (1991) noted that the value of copper increased as it moved south, away from the source area.

Though the value accorded objects during a potlatch was often tied to their display of clan symbols, it was also related to their status as an imported good. Access to materials only obtainable through trade was a prerequisite for occupying a prestigious position. According to Euroamerican fur traders, Northwest Coast Natives insisted on lengthy ceremonies prior to the actual trading of goods. These ceremonies included the display of ceremonial gear, often consisting of clan symbols, by chiefs, *i.e.*, individuals in hereditary positions of high status. Copper was often used in the manufacture of ceremonial objects such as masks and headpieces. The ownership of ceremonial gear was a prerequisite for managing intra-group trade and trade was a prerequisite for obtaining the goods that gave prestige. This cycle allowed high status groups and individuals to maintain their monopoly on prestige goods (Tybjerg 1977).

Referring to Bronze Age northern Europe, Pydyn (1998) stresses that only when objects were removed from their area of origin during long-distance trade did they become valuable. Thus, he echoes Tybjerg with the idea that the control of trade would then be crucial in obtaining prestige goods and prestige would come to rest with the office of chief rather than in a specific individual (Pydyn 1998).

Coast-Interior Trade

In the body of literature dealing with social complexity (*i.e.*, the development of rank) in northwestern North America, the discussion of the Northwest Coast is especially extensive. Some of these ideas, though not concerned with metal specifically, are particularly relevant for discussing the relationship between copper and ranking. Similar to Tybjerg (1977) and Pydyn (1998), Bishop's (1987) discussion of rank on the Northwest Coast of North America emphasizes geography and trade. During the proto-historic period ranking developed among groups living in the interior of British Columbia as a result of their interaction with coastal groups within the context of the fur trade. Using the proto-historic Carrier Athapaskans for his discussion, Bishop argues that rank was created by inter- and intra-group exchange of prestige goods that involved a system of trading partners. Because the coastal trading partners of the Carrier (Tsimshian and Gitskan) already had hereditary positions of high rank, similar positions developed among the Carrier creating equals for the purpose of facilitating trade in the form of reciprocal exchange (Bishop 1987). In an analogous situation the higher ranking individuals among the Chilkat Tlingit, geographically in a position to monopolize the southern movement of copper from both the Copper and White River regions, established trade relationships with Athapaskans through marriage (Tybjerg 1977).

Bishop proposes that inherited positions of rank among coastal groups were a result of the monopoly on prestige goods by individuals who managed to transfer those monopolies across time to succeeding generations. The Carrier had beaver skins, which the coastal groups desired for exchange directly with Euroamerican fur traders. As a result of the importance of beaver skins, access to beaver hunting grounds became restricted among the Carrier. The public potlatch was used by the Carrier to validate claims to the hereditary positions of rank that made coast-interior exchange possible. The existence of coast-interior exchange prior to the fur trade means that the mechanism for the development of rank in the interior was in place prior to the development of the Euroamerican fur trade (Bishop 1987).

Bishop's analysis seems particularly relevant when looking at the Ahtna (and Tutchone) who, like the Carrier, were interior Athapaskans trading with coastal groups. The Ahtna and Tutchone are both known for their emphasis on rank and

participation in slavery and for both groups the control of copper has been associated with this emphasis (de Laguna and McClellan 1981; Grinev 1993; McClellan 1975, 1981; Legros 1985; Townsend 1980). The exchange of copper from the interior to the coast predates the contact period fur trade as witnessed by the archaeological and oral history evidence from Yakutat (de Laguna *et al.* 1964). Though the fur trade may have accelerated the development of ranking among the Ahtna (and Tutchone), the mechanism for it, coast-interior trade, was already well established.

The Control of Resources

Ives' (1990) discussion of Athapaskan social organization sheds light not only on the development of ranking among interior Athapaskans but also on the existence of rank among coastal groups such as the Tsimshian and Tlingit. Discussions of social complexity, including that found on the Northwest Coast, whether the society in question is thought of as ranked or stratified, point to one or several of the following causal factors: sedentism (or increasing sedentism), population growth (sometimes associated with circumscription), warfare, and marine/riverine resources (richness, regularity/availability, storability). Ives' focus on the importance of place in the development of ranking combines aspects of sedentism with resource regularity and richness in the form of salmon fishing. The places that become important are those areas where many salmon could be caught with relatively ease and that became "susceptible to political control" (Ives 1990:334). Though this is an oversimplification of Ives' ideas on the development of ranking, his emphasis on place lends support to Bishop's (1987) discussion tying rank to a restriction on access to productive land. The importance of the discussion of place has obvious repercussions for the potential role of copper in the development of rank.

Native place names that incorporate terminology for copper are abundant in south-central Alaska (Kari 1983, 1990; Coutts 1980) and provide evidence of the importance of native copper to not only the Ahtna but also the Upper Tanana and Southern Tutchone. Naming places could be interpreted as not only acknowledging the presence of copper but also making claims to that copper as both Ahtna chiefs,

and one lineage in particular, were known for their control over copper resources (McClellan 1971; Shinkwin 1979). Like salmon, another localized resource credited with the appearance and, or, intensification of ranking, copper may have been highly susceptible to political control. The Lower Ahtna, whose territory provides the densest concentration of copper place names, not only occupied a copper-rich region but would have been in a position geographically to prevent more inland groups (but not the Southern Tutchone) from trading copper to the coast.

Summary

Property-based social status was well developed among the Ahtna, and as with stratified coastal groups, chiefs possessed slaves (Townsend 1980). As mentioned in Chapter 1 and described in Chapter 4, there was an emphasis on ranking in Ahtna society. This emphasis has been linked to native copper, an important source of wealth among the Ahtna, and it has been suggested that the emphasis on ranking was a result of the control of copper sources by individual headmen (Grinev 1993; de Laguna and McClellan 1981; Kari 1985; Pratt 1998; Wrangell in Grinev 1993).

As noted in Chapter 4, Ahtna chiefs and potentially one sib, were elevated in prestige as a result of their possession of native copper and control over its trade (McClellan 1971; Shinkwin 1979). An association between copper and status has also been suggested for the Tutchone. In recent times the highest-ranking family at Burwash Landing was recognized as being descendent from an individual known as the Copper Chief. This individual's importance was due in part to his control of the native copper sources in the White River. The Copper Chief, who may have been an Upper Tanana as that was his first language, was married to a Northern Tutchone from Fort Selkirk. He was known for his copper knives that were traded to the Southern Tutchone. The Southern Tutchone used long copper knives that were attached to shafts for use in battle and hunting bear. The Copper Chief's sons also became chiefs in their own right. In the 1970s the Copper Chief's descendants were still being referred to by their name plus the addition of Copper in front, *e.g.* Copper Lily (McClellan 1975, 1981).

Though archaeological evidence regarding the association of copper with individual status among the Ahtna may be ambiguous, historic and ethnographic information contributes to our understanding of this issue. Property-based social status was well developed among the Ahtna, and as with stratified coastal groups, chiefs possessed slaves (Townsend 1980). Among the Ahtna copper was an important source of wealth and it has been suggested that the emphasis on ranking was a result of the control of copper sources by individual headmen (Grinev 1993; Kari 1985; Pratt 1998).

Ahtna chiefs may have claimed ownership of specific locations for collecting copper and it has been suggested that copper became a more restricted commodity from prehistoric to historic times due to the intensification of exchange associated with the Euroamerican fur trade (Shinkwin 1979). However, the process by which this hypothesized change occurred has not been adequately explained. Perhaps the introduction of Euroamerican trade metal into northwestern North America resulted in the intensified use of a pre-existing source of wealth, *i.e.*, native copper, in order to compete with the newly introduced wealth, as suggested by Hickey (1984) for the Copper Inuit. Alternatively, even if coastal groups were less interested in native copper once they had access to trade metal (which has not been demonstrated), it may still have been desired by interior Athapaskan groups who lacked direct access to native copper. In the latter case it may have been traded for furs, which eventually made their way to the coast.

As detailed in Chapter 4, native copper was associated with, and considered the property of individual chiefs. Native copper was potentially also a source of group prestige. Kari (1985) suggested that the system of inherited chiefly names attached to major villages found among the Ahtna, but especially the Lower Ahtna, may have been related in part, to the location of copper sources and manufacturing sites. Though Kari (2005) later noted that the villages associated with chiefly names were concentrated in areas of productive salmon fisheries and were also found at strategic points along trail systems utilized to access hunting territories and for trade, the evidence for the control of copper sources by Ahtna leaders at the time of contact supports a relationship between ranking and copper.

Chapter 9. Conclusions and Future Research Directions

Archaeology, archaeometry, and ethnohistory have been used within an anthropology of technology framework to investigate the use of native copper in Alaska and the Yukon Territory. This approach examined the environmental, social, political, and economic context of native copper technology. The four primary objectives of this thesis, as stated in the introductory chapter were: (1) to provide a regional overview of the geological and archaeological occurrence of native copper, (2) to provide a contextual discussion of the technology of native copper metallurgy, (3) to discuss the relationship between native copper and social complexity, and (4) to address the potential for provenance studies. With regard to the last three objectives, this thesis provides insight that is relevant to areas outside of Alaska and the Yukon Territory.

Regional Overview

This thesis marks the first attempt at a regional overview of the geological and archaeological occurrence of native copper in Alaska and the Yukon Territory. Native copper occurs widely across southwestern Yukon and south-central Alaska with additional sources reported for northern Alaska. The Ahtna Athapaskans were credited with both the initial use of native copper in the region and with mastering techniques to work it. Archaeologically, native copper does not appear until the Late Prehistoric period, ca. 1000 AD. The archaeological distribution of native copper indicates that though this material may have traveled great distances via down-the-line trade, it is most heavily concentrated in what could be considered the supply zone. Native copper artifacts in this region appear to be overwhelmingly utilitarian in form and ethnohistoric sources offer descriptions of many of these artifacts and their uses. However, ethnohistoric sources, including myths and legends, also provide abundant evidence of the importance of native copper and native copper artifacts as a source of wealth and personal prestige.

The inventory, description, and analysis of native copper from archaeological contexts presented here represent an initial step towards the study of

native copper technology in the region (Alaska and the Yukon Territory) and greater northwestern North America. Additional, more formal analysis, such as inter- and intra-site analyses that take into account all material aspects of Athapaskan technology, i.e., lithic, bone, horn, and additional organics, will serve to place Athapaskan metallurgy, and discussions of the origin of metallurgy in general, within a more holistic context. A replicative study designed to assess the amount of labor involved with the manufacture of native copper tools would be a valuable contribution to the discussion of how this material was integrated into Athapaskan technology and society. An additional avenue for future research would be the compilation of regional inventories of sites with metal artifacts (native copper, iron, and trade copper) for the central Canadian arctic and subarctic and the Northwest Coast. Compiling this data for large areas will be a challenge, especially accessing unpublished material, but it would provide a more detailed picture of the initial appearance and spread of metals.

Native Copper Technology

In the Athapaskan worldview there is no distinct separation between the natural and supernatural worlds. Thus, there is no contradiction in the view that native copper was both supernaturally charged with symbolic meanings and associated with luck and wealth as well as incorporated into the more practical, *i.e.*, technical aspects of Athapaskan subsistence technology. The anthropology of technology can be summarized as a holistic contextual approach to technology. In other words, non-functional or non-technical factors such as religion, economics, kinship, etc., have an impact on a society's technology. Yet such an approach considers the material realities of technology and incorporates ecology and the natural environment as well as cultural factors.

Origin of Metallurgy

Viewed within such a framework, the archaeology of metallurgy is not the continuous innovation and invention of new, better (stronger, sharper, etc.) materials. Many statements regarding the origin of metallurgy are highly

speculative. The idea that the inception of metallurgy represented a huge technological leap forward for people of the past is related to the view that the invention of metallurgy is the result of intentional efforts to produce better tools. Many scholars have come to the conclusion that the transition from stone to metal, and from one metal to another may have had little to do with any sort of obvious functional benefits. The interest in metal often seems to be related to the creation of objects with ritual or social significance and early metalworkers should thus be viewed as possessors of esoteric knowledge within a ritual framework rather than as ancient materials scientists out to invent better tools. Indeed many scholars have noted that the invention or adoption of metals globally was often more closely tied to esoteric, ritualistic knowledge and prestige than to the search for harder, sharper cutting edges. Ethnohistoric sources for northwestern North America provide a glimpse of the ritual and symbolic importance of native copper as well as its use as a prestige material. However, based upon both archaeological and ethnographic data it is clear that native copper was also valued as a raw material for tools.

Ethnohistory

This thesis has made abundant use of ethnohistoric information in describing and interpreting the use of native copper in Alaska and the Yukon Territory. Much of this information was collected during the twentieth century from individuals who are no longer alive. Nevertheless, additional oral history research in Native communities about the use and importance of native copper, both before and after the coming of Euroamericans, has the potential to provide anthropologists and archaeologists greater insight into this specific aspect of material culture.

Metallography

A materials science approach has long been of value in interpreting native copper metallurgy in North America, including the refutation of scholarly myths (Cushing 1894; Willoughby 1903). However, researchers have at times confused description with interpretation, a common problem in archaeology. As Killick (1996) stressed, microscopy is most useful when the results are integrated into a social science approach.

It has been suggested that the debate over the use of native copper artifacts, whether for utilitarian or non-functional purposes (*i.e.*, social or symbolic) can be "resolved only with more metallographic and experimental data" (Childs 1994:235). In a similar tone, Franklin *et al.* (1981b:355) noted that because native copper artifacts are the result of shaping by plastic deformation, "the entire sequence of activities that has resulted in the manufacture of a copper implement can be recognized on the finished product."

These last two statements are perhaps overly optimistic. There are multiple explanations for why an artifact may be recovered from an archaeological deposit with an annealed microstructure that has nothing to do with it being used in a non-functional context. In some cases the cold-working of native copper artifacts may have been delayed until closer to the time of actual use. It is also important to note that when examining the microstructure of a native copper artifact only the final processing steps in the potentially long life of an artifact are visible. Due to the potential for native copper artifacts to be repaired and reused (Leader 1988) or remade into an entirely new form, metallographic analysis may only inform on the most recent of several processing episodes each of which could have included several annealing and cold-working stages.

Archaeometry plays an important part in the archaeological study of technology. But as Leader (1988:2) noted with regard to the analysis of metal artifacts, the identification of metallurgical process is "an important first step" but "it does not explain…the manner in which these processes were put to use…" and furthermore, "it is the manipulation of technical processes and their products that provides archaeologically relevant information."

When framed within an Anthropology of Technology approach, archaeometry can make a crucial contribution to the archaeological examination of technology. The metallography performed here confirmed that the objects studied were made of native copper and, as demonstrated by other relevant studies (*e.g.*, Franklin *et al.* 1981), that annealing was a routinely performed when working native copper. Furthermore, annealing is well within the repertoire of technological skills possessed by essentially lithic cultures. This has been demonstrated almost

everywhere that native copper was used. To separate native copper artifacts into either a functional or symbolic category (*i.e.*, make statements regarding their value) based upon whether the object was left in an annealed or cold-worked state (Vernon 1990) requires making assumptions that are at best untested and in some cases may be proven false (Leader 1988).

Social Complexity

The archaeological context of native copper in Alaska and the Yukon Territory provides little opportunity to test ideas about the relationship between material culture and ranking discussed by others (*e.g.*, Peebles and Kus 1977; Wason 1994). There are no native copper artifacts associated with burials or caches in this region (though native copper has been recovered from burials on the Northwest Coast, *e.g.*, Ames 2005). Precontact Athapaskan treatment of the dead generally involved cremation (see de Laguna and McClellan 1981 on the Ahtna, McClellan 1981 on the Tutchone, McKennan 1981 on the Tanana, and Osgood 1937 on the Dena'ina).

There are essentially no native copper artifacts that could be considered luxury items and relatively few items of personal adornment. As mentioned above, the distribution and form of native copper artifacts regionally does not support its identification as a prestige technology as described by Hayden (1998). Ethnohistoric sources do offer insight into this aspect of the value of native copper. The most convincing archaeological example of the use of native copper as prestige technology comes from the presence of objects of personal adornment (bracelets) found at the coastal site of YAK-007, though these were not recovered from burials. Additionally, Shinkwin (1979) suggested that the differential distribution of native copper at VAL-065 could be an indication of differential access not only to native copper but also power. However, only a portion of the site was excavated. A relevant warning was made by Michels (1979), who found that even artifacts (and perhaps raw materials) known to be associated with rank in one culture may not have the same association in another culture and may have different meanings over time.

To claim that copper created ranking among the Ahtna, or any other indigenous group, would require one to ignore interdependent factors such as increasing population, increasing sedentism, and the development of storable food surplus, all of which have been hypothesized as prerequisites for the development of rank on the Northwest Coast. Indeed, searching for a single material cause or mechanism that explains why an egalitarian society becomes ranked is problematic. As Coupland *et al.* (2001:243) concluded in their investigation of resource abundance and rank among the Tsimshian, "human agency, specifically, the strategic use of social mechanisms…", not resource abundance, was the "primary factor determining Tsimshian local group rank." Humans are capable of responding to new circumstances (*e.g.*, resource abundance) in a variety of ways that may not require the introduction of new cultural mechanisms such as the development of hereditary rank, which has at times been presented as a natural, evolutionary response to specific, though variable, circumstances (Chapman 2003).

Did the higher value accorded native copper among coastal groups as a marker of high status and individual prestige cause Ahtna chiefs to restrict access to native copper sources in order to control its movement through trade? And if so, how did this affect the value of copper within Ahtna society? Furthermore, was the ownership of copper sources transferred across generations from one chief to another (regardless of sib affiliation) in contradiction of the Athapaskan egalitarian ideal? Though ethnohistoric data greatly add to our understanding of the importance of native copper, these are difficult questions to answer. One avenue for further research, briefly touched upon in this thesis, is the examination of the relationship between social complexity and native copper craft specialization. Ethnohistoric sources, though at times contradictory, indicate that native copper was associated with prestige and rank not only in Northwest Coast society, *i.e.*, Tlingit, but also among Athapaskan groups such as the Ahtna, Dena'ina, and Tutchone. Contradictory statements from ethnohistoric sources regarding copper, especially its value and ownership, may be due to the tension resulting from the use of copper as a prestige item within an egalitarian society.

Provenance

The provenance work reported here was essentially a pilot study. It demonstrated that there is potential to discriminate between different native copper source areas (*i.e.*, stream drainages) in the region based on the trace elements. The native copper from Kletsan Creek could be distinguished from that from Dan and Chititu Creeks based largely on the presence or absence of As, Hg, and Se. The trace element pattern of the artifacts from GUL-077 more closely resembles that of the Dan and Chititu Creek material. Due to the number of unsampled native copper sources in the region the assignment of the GUL-077 artifacts to Dan and Chititu Creeks would be premature. However, Kletsan Creek can be ruled out as a likely source for the GUL-077 artifacts. Sourcing a native copper artifact from this region or the Northwest Coast to a specific native copper locality with any degree of confidence will require the collection of numerous samples from multiple remote locations. This would be a costly and time-consuming endeavor.

Of the two techniques used, INAA and ICP-MS, INAA proved to be the most useful, largely due to the inability to analyze for Hg using ICP-MS. An additional important finding of the provenance research was the demonstration that Pb isotopes are unlikely to be of use in attempts to source native copper. INAA is unable to analyze for Pb trace elements because Pb does not activate well. Several native copper samples were analyzed for Pb isotopic data using LA-MC-ICP-MS. Though only trace amounts of Pb could potentially be enough to provide isotopic data, the results indicate that if Pb were present it is in amounts too low to be detected. The scarcity of Pb was further corroborated by the results of conventional ICP-MS.

The source of copper used by the indigenous peoples of northwestern North America has often been attributed to the copper-rich region of the Wrangell and Saint Elias Mountain ranges, which includes the Chitina and White Rivers. The extent to which the copper-rich region of southeastern interior Alaska and southwestern Yukon has been credited as the source for copper found in archaeological contexts throughout the Northwest Coast may be an exaggeration. In addition to the potential sources of native copper listed in Chapter 3, Rapp *et al.*

(1990) built of a collection of native copper that includes material from additional locations in Alaska and the Yukon Territory. Native copper has been reported for the Northwest Coast region from: Alaska (*e.g.*, Wright and Wright 1908), British Columbia (*e.g.*, Chapman 1979 in Burley 1981; Drucker 1943; Sanger 1970; Mayne 1861 and Boas 1890 in Wilson and Carlson 1980; sources cited in Acheson 2003 and Hayden and Schulting 1997), and Washington (Hayden and Schulting 1997). Though ethnohistoric sources on the Northwest Coast emphasize the importance of native copper from south-central Alaska and southwestern Yukon (*e.g.* Acheson 2003, de Laguna 1972; Emmons 1991; Rickard 1939; Swanton 1909), a Tsimshian legend tells of the presence of copper in the Skeena River and Cassiar River (Boas 2002). Rapp *et al.* (1990) provide additional locations of native copper in British Columbia. Multiple sources of native copper have been noted for the central Canadian Arctic and Subarctic region (Hearne 1958; Kindle 1970, 1972; Rapp *et al.* 1990 and others cited in Franklin *et al.* 1981a).

As mentioned earlier, native copper was potentially available to Northwest Coast societies from other sources further south in British Columbia. Additionally, as discussed earlier the use of native copper on the southern Northwest Coast in Prince Rupert Harbour (Ames 2005:234) predates the appearance of native copper at YAK-007 in Yakutat Bay by about 2000 years (de Laguna *et al.* 1964:202-206) and in the source area of southeastern Alaska and southwestern Yukon by about 1500 years (Hanson 1999; Workman 1976:142-145, 1977, 1978). The sourcing work of Goad (1980) and Levine (1996, 1999) has proven false the assumption that artifacts of native copper found throughout southeastern and northeastern North America were all derived from native copper from the Great Lakes region. In both cases, local sources of native copper existed and were used. Though ethnohistoric source indicate that native copper from Alaska and the Yukon Territory was transported a great distance south along the Northwest Coast, it is likely that more local sources of native copper were used in this region.

Concluding Remarks

Native copper was a raw material valued for its potential use in functional, social, economic, and symbolic contexts. The status of copper as a prestige good among both egalitarian and trans-egalitarian Athapaskan groups of northwestern North America and the even more rank-conscious groups on the Northwest Coast, makes it an ideal aspect of material culture for investigating not only trade exchange but also the creation of value and ranking. Though some specific collecting localities used by indigenous groups are well known, there are still unresolved issues regarding the indigenous use of native copper in Alaska and the Yukon Territory and other parts of northwestern North America including: the time and place of its initial use, the relationship between native copper working traditions found across northwestern North America, the degree to which the value of copper changed over time, and the extent to which the control of sources led to, or helped facilitate, the development of ranking.

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